3: Mariner F-5 (1806-1810) 1818
OU9 Tonga OU9

allotment is made once a year, just before the yams in general are arrived at a state of maturity; those which are used in this ceremony being of a kind which admit of being planted sooner than others, and, consequently, they are the first fruits of the yam season. The object of this offering is to insure the protection of the gods, that their favour may be extended to the welfare of the nation generally, and in particular to the productions of the earth, of which yams are the most important.

The time for planting most kinds of yams is about the latter end of July, but the species called *caho-caho*, which is always used in this ceremony, is put in the ground about a month before, when, on each plantation, there is a small piece of land chosen and fenced in, for the purpose of growing a couple of yams of the above description. As soon as they have arrived at a state of maturity, the *How* sends a messenger to Tooitonga, stating that the yams for the *inachi* are fit to be taken up, and requesting that he would appoint a day for the ceremony: he generally fixes on the tenth day afterwards, reckoning the following day for the first. There are no particular preparations made till the day before the ceremony: at night, however, the sound of the conch is heard occasionally in different parts of the

3: Mariner F-5 (1806-1810) 1818
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651 islands, and as the day of the ceremony ap-
796 proaches it becomes more frequent, so that the
244 people of almost every plantation sound the
[202] conch three or four times, which, breaking in upon the silence of the night, has a pleasing effect, particularly at Vavaoo, where the number of woods and hills send back repeated echoes,
[824] adding greatly to the effect. The day before the ceremony, the yams are dug up, and ornamented with a kind of ribbons prepared from the inner membrane of the leaf of a species of pandanus, and died red *; when thus prepared, it is called *mellecoola*, and is wrapped round the yam, beginning at one end, and running round spirally to the other, when it is brought back in the opposite direction, the turns crossing each
651 other in a very neat manner. As the ceremony
796 is always performed at the island where Tooitonga chooses to reside, the distant islands must make these preparations two or three days beforehand, that the yams, &c. may be sent in time to Vavaoo, where we will suppose the affair is to take place. The ninth day then

* It is first soaked for six or eight hours in lime water, and afterwards in an infusion of the root of the *nonó*, where it remains for about a week; it is afterwards exposed to the sun, and becomes of a bright red: the root of the *nonó* is of a dark bright yellow, which, upon the action of lime water, becomes red.

8: Collocott & Havea M, I-5 (no date) 1922
OU9 Tonga OU9

2. Api faa toe tuu ai ae teve: In the well-stocked farm still stands the *teve*. 539 262

The *teve* (Amorphophallus) grows wild in the bush. Its root has an acrid taste, but is nevertheless sometimes eaten in periods of scarcity. The true farmer, however well stocked he is with other food plants, will not neglect this unpalatable shrub which will be a stand-by in case of the failure of his other crops.

3. Fakamotua ke tao ha tua: Playing the old man to bake a *tua* (a fine kind of yam).

The *tua*, in addition to being a specially good sort of yam, is also one of the hardest varieties to cultivate, and the man who can grow them well is obviously a real farmer. This phrase is a rebuke for a lazy man. Do you expect that sitting down with folded hands like a decrepit ancient is the way to get these fine yams to bake and eat? [244] [626]

4. Halahala a maala keli: Misses of well cultivated garden, that is, a yam garden in which the soil is loosened to a good depth and where fine large pieces of seed yam are used. 539 244

In such a plantation there may be some holes which miss, but those which do grow well will have such large roots as to compensate for the failures. Applied especially in such sports as boxing, fishing and the like, to one who may fail often to get his blow home, or to catch any fish, but when he does succeed scores so heavily as to redeem his previous failures. [526] [226]

5. Holi ke utuutu i he maala utu: To desire to glean in a plantation that is being harvested.

Utuutu is to look for yams in the bush growing wild on the sites of disused gardens. What one finds in this way he is welcome to, but such gleaning must not trespass on gardens which are still being used by their owners. [423]

6. Huo hoko hoka huo: Digging together, spades clashing. 539

If two men are working close together and one strikes his spade against his companion's the accident is likely to prove annoying and lead to a quarrel. The expression, therefore, is an injunction to keep strictly to the line of one's own job without irritating interference with neighboring laborers. 578 461

7. Kaka tuu ofi: Barren soil near at hand.

An inferior piece of ground conveniently close is more likely to be cultivated than better soil at a distance. The thing of fair quality that is near is better than a superior thing at a distance. A bird in the hand is worth two in the bush. 539 241

8: Collocott & Havea M,I-5 (no date) 1922
OU9 Tonga OU9

539 461 829 **8. Nae hanga ki fe hoo sipeiti:** Where was your spade turned, that is, what has your spade been turned towards?

This is the usual retort to one who begs that which he should have prepared for himself. It refers primarily to the produce of the garden but is used of wealth generally. The word *sipeiti* is not Tongan, but a corruption of the English "spade." Whether, before contact with Europeans, there was a similar expression with the real Tongan word for a spade or digging-stick, we are unable to say.

539 241 461 **9. Matenga i vao kaka:** Fatigue in barren soil.

The word *vao* signifies a piece of scrub land. The husbandman in preparing for his garden selects a site and clears the brush. This expression is applicable to one who undergoes the labor and fatigue of clearing and planting a piece of land that proves unfertile. It is labor in vain.

539 173 643 581 **10. Ne ongo e fena ka ko Nua:** Although she has sprouted yet *Nua*.

An early Tui Tonga sent to the chief Loau for one of his daughters. Instead of asking outright for the girl the Tui Tonga's messenger was instructed to ask Loau for yams. Possibly the messenger himself did not know the purport of his errand but Loau at once understood, probably from previous agreement between himself and the Tui Tonga. Loau had two daughters, the younger not yet of marriageable age, the other named Nua, had recently borne a child. Loau, therefore, still in the language of the yam crop, returned answer to the Tui Tonga that one part of the crop was not yet ripe, and that the other part had already sprouted, using the word *fena*, which means a piece of seed yam which has been planted and commenced to grow. The Tui Tonga replied as above, meaning of course that although Nua had borne a child to someone else yet he still wanted her, for she was a very beautiful woman.

11. Oku fena ae tau kei mula ae tau: The crop is sprouting, the crop is still unripe.

As explained in No. 10, the reference is to the answer of Loau to the Tui Tonga, who sent for one of Loau's daughters. One is over-ripe, and the other is not ripe enough.

539 245 **12. Paki moe talaha:** Pick the remainders too.

In the breadfruit tree all the fruit do not ripen together, and so in plucking the crop the ripe fruit will be taken and the others left to mature. This expression means to strip the tree bare of unripe as well as of ripe fruit.

539 244 622 **13. Pala a kahokaho:** Rottenness of the *kahokaho*.

The *kahokaho* is a species of yam which grows to a great size and is highly valued. It is a chiefly yam, that is, one especially suitable for presentation to a chief. Even if this prime vegetable has commenced to decay yet it is a *kahokaho*, and something better than the best specimens of many other kinds of yam. Besides what may be called its ethical qualifications due to its rank in the yam hierarchy it is a physically fit tuber, as the remainder of the flesh is not affected by the beginnings of decay.

8: Collocott & Havea M,I-5 (no date) 1922
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14. Taka i fonua mahu: Going about or living in a fruitful land. 539 181

This indicates the general prosperity and comfort of a people when crops are good and none suffers want.

15. Tatau pe tua mo palai: The *tua* just like the *palai*. 539

The *tua* and the *palai* are two sorts of yam, of which the *tua* is much the finer. That which is excellent leaves its proper excellence, becoming the mere equal of things of no account; the chief descending to be no better than the commoner. 244 554

16. Toukai mo hono lohu: A crop of fruit and its *lohu*. 539

The crop referred to is the breadfruit. The *lohu* is the forked stick used for picking the breadfruit. When the breadfruit is ripe a man may find that the stick that he has used in a previous season is rotten, and so he has to get another. Probably these sticks are very seldom kept from season to season. The idea is that with the crop one must get a stick for that crop. So of the needs and opportunities of a particular period the men will be found to meet them. 245 [829]

17. Ufilei fie ufi: An *ufilei* that wants to be a yam (*ufi*). 539

Ufi is the general name for all kinds of yam. The *ufi-lei* is a small sweet yam. This indicates one of these small sweet yams that wants to be some other sort of yam. Applied to people who not satisfied with being what they are try to be like someone else. 244 554 829

18. Utu ta lau: Harvesting, cutting off leaves.. 539

This is an expression from the yam harvest and indicates primarily a man who digs his yams before they are quite ready, when the tops will have died off. He strikes or cuts off the tops as he digs his crop. The application of such an expression in Tongan is similar to what it would be in English. 244

PLANTS AND TREES

19. Akau tuu hala: Tree standing (in a) road, and so liable to be splashed with mud, struck with knives, or otherwise injured. 539 824

This proverb or this explanation is probably modern, as before the introduction of wheeled traffic and of steel implements it would seem that the road-side tree was not exposed to especial injury. However, even under ancient conditions the road-side tree would offer itself first to those in search of timber. [313]

20. Faifaimalie naa ke pakii ha lau telie: Go carefully lest thou pluck (break off) a *telie* (*Terminalia catappa*, or *T. litoralis*) leaf. 539 784 829

This phrase is a warning to proceed with care lest a tabu be broken. We do not know its origin.

8: Collocott & Havea M,I-5 (no date) 1922
OU9 Tonga OU9

539 245 412 829 therefore, indicates the coconut living with that which destroys it. Used of one who is in close contact with that which is his undoing. (Compare No. 243.)

539 245 858 **48. Potopoto a niu mui:** Wisdom of a young nut tree.

A young tree will sometimes bear a crop as though it were clever at that game, but will pass fruitless through another season. So children will at times behave with all the discretion of adults, but such conduct cannot be expected to be the permanent characteristic of the young.

539 245 **49. Tautefua a niu motuu:** A ripe nut hanging by itself.

There is only one nut on the stalk, but that one is perfect and ripe. A thing of which there are very few, and those few are of fine quality. A man who stands alone, but who is exceedingly capable.

539 184 **50. To lou oji:** Leaf fallen finished, that is, all the leaves fallen.

This is not a familiar form of expression in most parts of the Tongan group, in fact it is ungrammatical; it may have originated in Niua Foou where it seems that such a form is permissible. The phrase is not known, or at least not generally known in Tongatabu. Baker gives, "destitute"; poverty, or rather the poor, being represented as a tree denuded of leaves.

539 824 **51. Tupu lautolo:** Growing (like) *lautolo.*

The *lautolo* is a fast-growing, strong-creeping plant. To grow like this plant is to grow quickly and strongly.

539 244 578 **52. Tuutuu kau tala:** Stand about I'll tell.

Used for one who makes slighting or offensive remarks about another who, unknown to the speaker, is near by and listening. There is a plantain called the *tuutuu-kau-tala.* Both the name of the plant and the meaning of the expression are connected with the legendary hero Muni, who was cast away at sea at, or before, birth and washed ashore on the island of Lofanga in Haapai. He was found and adopted by a childless couple of Lofanga, but as he grew to manhood his adoptive parents became anxious to get rid of him. Returning home one evening Muni overheard from just outside the house his supposed parents talking about him inside the house. He leaned against a plantain, of the sort now called *tuutuu-kau-tala,* and heard what they had to say. There is a couplet referring to this incident:

Hau ai o tuu kau talai	Come and stand while I abuse
Aeni ne ui ai he hopa ni.	You after whom was named this plantain.

539 824 571 **53. Ulu akaua:** Overshadowed with trees.

A tree that is dwarfed, unable to reach its full stature and vigor, by reason of a crowd of other trees standing close about it. Used of a warrior who is overcome by the number of foes that press together upon him. Generally of one who, no matter how great his spirit and skill, is overwhelmed by the multitude of difficulties that confront him.

8: Collocott & Havea M, I-5 (no date) 1922
OU9 Tonga OU9

539 776 825 971 of the creatures of which the gods "made boats," as Tongan idiom has it, that is, in which they appeared. The proverb is applied to one who makes use of some other person or thing in order to effect his purpose.

382. To fuji aki vahaa ufi:

539 782 244 Baker renders this phrase, "A part of the heathen ceremony at the *Inaji*" (An English and Tongan and Tongan and English Vocabulary, p. 209). We have been able to find out nothing about this. Written as above it seems to have the perfectly simple sense of planting plantains between yams. It has been suggested that the correct meaning may be: to use the space between the yams as a measure to calculate the distance apart to plant the plantains. This also is quite in accordance with the literal meaning of the words. We may divide differently, and write, *To fuji aki vahaa ufi*, which would seem to mean, "running in between yams." We have not discovered either what part of the *Inaji* was so named, nor what proverbial application the phrase had.

THE PERSON

CLOTHING AND ADORNMENT

539 302 154 554 565 **383. Fie namu pako:** - Wishing to smell of *pako*.

The *pako* is a sweet smelling plant used for scenting oil, especially the oil of chiefs. The expression is capable of two kinds of application: desiring to do well that one's life and actions may have a fragrant odor, and the less generous meaning of conceit, trying to be like the chiefs.

539 735 291 **384. Fuji mo omo:** Pulling and slipping.

Used as noun or adjective equivalent to poverty, poor. Said to indicate literally one who is so poor that he cannot afford enough cloth for a proper sized *vala* (kilt), but has to put up with something so small that when he pulls it one way to cover a part of his body another part is left bare. Whether this be so or not it has come to mean those who have difficulty in "making ends meet."

539 291 301 **385. Laukau falelava:** Finery of various sorts.

Laukau, personal adornment, is used with the rather depreciatory nuance with which in English we speak of overdone, or over-vivid finery. *Laukau falelava* is not unlike such a colloquialism as, "Having 'em all on."

539 421 513 **386. Mafana a penu kehe:** Warmth of another's bed-clothes.

One man may have made himself very snug in another's covering, but can have no real ground of complaint when the rightful owner comes along and takes what belongs to him, leaving the snug man cold. So generally one may enjoy the advantage of using another man's property but he has no kick coming when the owner takes it to use for himself.

9: Collocott M-5 (no date) 1922 OU9 Tonga OU9

805 three generations since this happened" or "It occurred when my father's father was a child."

A general word for long ago, ancient times, is *onoaho*, as *onoponi* is used for recent time, the present age. There are several expressions for remote antiquity, as, *Hau o Momo* (when Momo was king), *Hau o Tuitatui* (when Tuitatui was king), *Hau o Muni Matamahae* (when Muni of the Torn Eye was king), *Hau o Motuku Veevalu* (when Motuku Veevalu, literally Eight-legged, was king). There are of course other words meaning uncountable, long enduring, which may be used to express the same idea of remotest antiquity.

SEASONS AND MONTHS

The Tongan year is said to have begun at about the same time as the Christian year, though no satisfactory explanation is given.
[171] Gill[11] states that the Mangaians begin their year about the middle of December, the point of departure being marked by the appearance of the Pleiades on the eastern horizon just after sunset. This or some similar astronomical phenomenon may possibly have determined the beginning of the Tongan year.

[821] The two broad divisions of the year, in one of which the days
[132] and nights are cooler than in the other, were recognized and used
805 to classify seasons. Close observation of the habits of plants and
824 of animals provided a basis for more exact division. The times
825 when certain trees cast their leaves, flowered, or bore fruit were utilized in making the calendar, as were also the periods when par-
805 ticular fish appeared. The greatest importance attaches to the
244 various stages of the growth of the yam. A large part of the nomenclature of the moons is based on seasonal changes observed in this plant.

805 The normal year consisted of twelve months, though some years had thirteen. The nomenclature is largely agricultural, but there seems no reason to doubt the statement that the names were applied to the moons. The months and the commonly received explanations of their names are as follows:

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[113] [11] Gill, W. W., Myths and songs from the South Pacific, p. 317, London, 1876.

9: Collocott M-5 (no date) 1922 OU9 Tonga OU9

1. **Liha-mua:** Early nit, December-January. This is the time when the first planted yams are forming roots. At this stage of growth little protuberances or roughnesses, like nits, appear on the heads of the roots. The name is also explained in a more general way. Many fish spawn at this time, and many trees show tiny fruits. A word for little things is nitlike, *ngalihaliha*, and the month is said to be so called because many things are "nitlike" at this period.

2. **Liha-mui:** Late nit. January-February. All the yams, late as well as early, show the little nitlike protuberances.

3. **Vai-mua:** Early rain (water). February-March. The first rainy month.

4. **Vai-mui:** Late rain. March-April. The second rainy month.

5. **Fakaafu-moui:** Putting forth living shoots. April-May. This is a time of vigorous growth with healthy suckers and shoots appearing on many plants. The word *afu* applies especially to the suckers of the *hiapo* (paper mulberry), but is also used more widely. The *fuji* (plantain) and *fau* (*Hibiscus tiliaceus*) should now be planted.

6. **Fakaafu-mate:** Dead, dying, suckers or shoots. May-June. Suckers are now not so vigorous, and dead tops of the yams appear.

7. **Hilinga-kelekele:** Laying earth, that is, either laying of earth or laying on earth. June-July. This is the month in which to start digging the yams. One explanation of the meaning of the name is that the harvested yams with earth adhering to them were laid on platforms constructed in suitable places, as under a tree or in a house, and that the name owes its origin to the fact that the adhering earth was laid down with the yams. Another explanation is that the yams were taken up and laid on the surface of the ground. The two interpretations are not inconsistent, for yams laid on a platform might still be said to be put on the ground. The name itself does not convey a precise meaning.

8. **Hilinga-meaa:** Laying *meaa*. July-August. This is the time to dig and store the remaining yams. These late yams are the biggest, and a portion of the garden is reserved for the special sorts of yam which grow to the largest size. The literal meaning of *meaa* in this place is doubtful. An explanation connects the word with *umea* (clay), and is to the effect that the big yams grow down into the clay which adheres to the roots when dug: but this interpretation is more than doubtful.

9. **Aoao:** August-September. The literal meaning of *Aoao* is obscure, a derivation for the name has been suggested which connects it with *hau-aoa*, used of rotting yam seed. The time for cutting yam for seed is now over, and it is said that if seed be cut in this month a considerable proportion of it will rot.

10. **Fuufuunekinanga:** Full leafiness. September-October. The yams, which have been planted about June and July, are now in full leaf.

11. **Ulu-enga:** Yellow head. October-November. This name is referred both to sea and land. Several sorts of fish are at a stage in their

9: Collocott M-5 , (no date) 1922 OU9 Tonga OU9

221 805 136 331 244

growth when their heads are yellow under the scales. Ashore this is a time of scarcity, whence the proverb, *Ka ai ha ofa tatali ki Ulucnga.* If there is any kindness (gift) wait till Ulucnga, when presents of food will be most useful. When yams are dug a small piece of the root is sometimes thrown back into the hole. These pieces grow into yams, which though small are deep in the ground on account of the manner of their planting. During the time of scarcity people search for these little yams, and in bending down to throw the soil out of the deep holes they are likely to make themselves yellow-headed.

221 805 244

12. **Tanu-manga:** Throwing soil on branch, fork. November-December. A growing yam is likely to project slightly above the ground, and frequently a small yam grows down from the same stem thus making a branch or fork on the head of the root. In this month if the head of a yam appears forked (*manga*), the gardener banks it over with soil (*tanu*).

With Tanumanga the year normally ends. If, however, observation of the yam and other plants and of fishes at the next new moon fails to discover the appearances proper to the month with which the year begins, Lihamua, another month is intercalated.

221 805 415

13. **Ooa-ki-fangongo:** Using a coconut-shell as basket. *Ooa* is said to be a reduplicated form of *oa*, one sort of basket; *fangongo* is an empty coconut-shell cut open and used as a receptacle for small things. This is a time of scarcity, and the idea is that one needs but a small receptacle in which to place his food.

NIGHTS OF THE MONTH

805 With the Tongans, as with other Polynesians, it is habitual to count by nights rather than by days. Where the English speaker says "five days after" the Tongan says "five nights after." An intelligent Tongan suggests as a reason that his people treat the hours of daylight and of the succeeding darkness as one day and that in reckoning the closing portion of the day is considered.

The division of the month was based on the phases of the moon, and the days or nights were counted within the month, several of the nights having special names. Expressed perhaps in a better way, there were special names for the moon in several of 805 her phases. The fisherman has strong reasons for close observance 226 of the moon, as some days are *aho iku*, fish days, favorable for the catching of certain sorts of fish. These fish days evidently vary with different localities and for different species of fish.

805 821 It is asserted that the appearance of the moon in a looking-

13: Beaglehole & Beaglehole E-5 (1938-1939) 1941
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land. Tree stumps may be left in the ground or an attempt made to burn them out. Depending upon the area to be cleared and the urgency involved, this work may be done by the men of the household, by a working-partnership of several men, or else many men may be invited to participate, each clearing a small section in return for the first yam-harvest from the section cleared. Again, depending upon taste and other factors of choice, one or more of several different kinds of tubers may be planted in quantity.

Taro is easy to grow. Cuttings are planted and re-planted each time tubers are harvested. The tuber takes about a year to mature. The giant *taro (kape)* is best planted between the months of March to September. It takes about eighteen months to mature. The gardens are occasionally hoed to keep back the growth of weeds.

The sweet potato is also an easy tuber to grow. It is best planted in the months between March and October. It is planted in big hills, perhaps five hundred hills at a single planting. The tuber takes from four to five months to mature. The garden is hoed once during this time.

Plantain shoots are planted from June to January. The tree takes about one year to mature and at the end of this time about five shoots may be replanted from this one tree. A man will have between forty and one hundred plantains growing in his garden.

Breadfruit takes up to five years before it bears a good crop. Coconuts take about four years to mature. The coconut is generally self-seeding though plants may be cultivated if the land is poor in coconut-production. Papaia, a staple article of diet, is self-seeding. No attempt is made to cultivate this fruit. Pineapples may be planted at any time of the year, requiring about a year before the fruit is ready to harvest. Mango, oranges, limes, and lemons are not cultivated but grow wild. Watermelons are planted between June and March, but because of the ravages of the fruit fly, cultivation is hazardous.

It is on the yam however, that the village cultivator lavishes most care and attention. The yam is considered one of the most delicate-tasting of Tongan tubers and the best of Tongan foods. The first yams of the new season are

13: Beaglehole & Beaglehole E-5 (1938-1939) 1941
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244 262 often reserved for a feast-occasion. Expressions of satisfaction are heard on all sides as the guests neglect the commoner tubers and concentrate on the yams. To our taste the yam did not seem particularly delicate nor greatly [123] different in flavour from other tubers. But it would have been impolitic to inform our hosts of our real opinion in this matter.

244 There are some twenty-one different named yams that the villager may grow. At most he will plant no more than half this number depending upon his judgment as to which 244 are hardiest and most worm-resistant. The first yam-221 cuttings are planted in June, very early in the month or else at the time of the full moon. A second planting takes place in August and a third from September to December. July is considered a bad planting month because worms are more 244 likely to attack the shoots at this time. About one hundred yam-cuttings are planted in each large hill. After the cuttings have developed strong shoots, the hill is opened, the yams replanted, from four to five shoots in each separate hill. These small hills are again reopened and one shoot is finally planted in a separate hill. For each complete planting therefore, there are three minor plantings. Sticks are used as supports for the growing shoots. The yam-gardens are weeded and kept clear. Each hill will finally produce four or five yams. They are mature in from five to eight months' time. The June planting for example, will be ready in December if there has been adequate rain toward the end of [433] this period. One acre of land will grow about one thousand hills of yam. From four to six hundred hills is considered an adequate planting for the average household.

241 To give some idea of the size of the Pangai garden, the following figures were obtained for a small household of four persons. This household had planted about five hundred *manioke* (manioc) plants, one hundred hills of yam, eight hundred *taro* plants, sixty giant *taro* plants, forty banana trees in full bearing, together with small amounts of corn, melons and *kava* trees. Most of this was planted in August, 1938, when the family returned from a long visit to Tongatapu. On January, 1939, it was planned to plant a further three hundred *taro*

14: Thomson G-3 (1886-1891) 1894
OU9 Tonga OU9

eating the yams, or destroying the produce of the land, the owner of the hog shall be at once informed that he may shut the hog up, and he shall restore whatsoever be damaged. If the owner neglect to take warning, either in confining his hog, or in recompensing the damage done, and the hog be again found eating the yams, it shall then be lawful to kill the hog, and the owner of the plantation shall have the carcase for his own.

A giant yam.

By the end of 1855 the original code had been so tinkered by the missionaries that little of the original remained. Their hand is detected in the following excellent provision, designed to check the growing indolence of the people, and turn their labour into a channel of profit to the reverend legislators:—

XXXVI. *The law relating to men.*—You shall work and persevere in labouring for the support of your family as well as yourself, and in order to contribute to the cause of God and the chief of the land, and each man shall find a piece of land to cultivate. Any man who is not willing to work, shall not be fed nor assisted, all such persons being useless to the land and its inhabitants, and unprofitable to their friends.

21: Simkin U-5 (no date) 1945 OU9 Tonga OU9

The chief barrier to this development seems to be a general satisfaction of the commoners with things as they are. They have always been content to leave things to the chiefs, and have no serious grievances to stimulate them to political energy. Democratic institutions are seldom real or stable if they drop from the clouds; they become rooted in a society only when its people have learnt to appreciate and operate them, as a result of struggles to remove hardships. In Tonga progress towards political democracy is retarded, not so much because the present government is rapacious of power, as because it is productive of popular good.

Agriculture and Land Use[1]

The Tongan is a peasant, cultivating his compact holding in his own way, subject only to the easy and sensible requirements of the land laws.

[1]The following tables provide a statistical summary of the nature of Tongan agriculture:

DISTRIBUTION OF FOOD TREES (1939 Census).

Group	Coconuts	Bananas	Pineapples	Other Food Trees
	%	%	%	%
Tonga Tapu . .	39	46	43	39
Ha'apai . . .	26	22	20	7
Vavau	26	23	26	35
Niuas	10	9	13	19
Total for Tongans	3,059	638	314	875
Total for Kingdom	3,260	682	335	890

DISTRIBUTION OF PRINCIPAL CROPS (1939 Census).

Group	Yams	Kumalas	Tapioca	Other Plants
	%	%	%	%
Tonga Tapu . .	55	57	42	28
Ha'apai . . .	14	25	38	22
Vavau	27	5	13	40
Niuas	4	13	8	9
Total for Tongans	1,504	600	1,245	1,671
Total for Kingdom	1,610	647	1,309	1,842

DISTRIBUTION OF LIVESTOCK (1939 Census).

Group	Pigs	Poultry	Goats	Cattle	Horses
	%	%	%	%	%
Tonga Tapu . .	39	36	44	78 (a)	60
Ha'apai . . .	29	26	23	3	15
Vavau	17	24	30	17	20
Niuas	15	13	4	1	5
Total for Tongans	19,120	49,744	3,484	1,024	5,016
Total for Kingdom	19,754	50,378	3,572	2,634	5,179

(a) The actual number is 2,058 of which 1,549 are owned by Europeans.

21: Simkin U-5 (no date) 1945 OU9 Tonga OU9

into Tongan consumption is shown by the following list of per capita expenditures in 1938: Biscuits 11d; Butter 8d; Drapery 6s. 4d; Flour 4s. 9d; Tinned meat 4s. 7d; Soap 1s. 3d; Sugar 1s. 9d; Kerosene 1s. 0d. (est.). A typical household probably spends about £6 a year on store goods, but it should not be thought that this modest outlay reflects satisfaction with the Tongan standard of living. The people are eager to buy imported commodities, particularly drapery, tinned meat and kerosene, but are severely restricted in their purchases by low cash incomes. Imports always respond closely to exports, and exports depend overwhelmingly on the price of copra.

Copra has always been by far the most important export, and during the last twenty years it has been Tonga's misfortune that copra prices have fluctuated about a steeply declining trend. In the decade after 1924 they fell from £20.5 a ton to £5.9, recovered to £13.1 in 1937, but fell again to £6 in 1941. As a result export income shrank from about £270,000 a year in the early 'twenties to £104,000 in the late 'thirties. The Kingdom's dependence upon this erratic and precarious source of income has been relieved by a growing export trade in bananas which began in 1932 when the New Zealand government allotted banana quotas to the various island groups, and gave Tonga 20 per cent of the Fiji quota. In 1938 shipments amounted to 11,000 cases for a return of £35,000. Since then the quotas have been lifted and the New Zealand f.o.b. price raised from 7s. to 9s. a case, with the result that Tonga exported £36,000 of bananas in 1942. Bananas now account for a quarter of Tonga's exports, and it is to be hoped that this valuable and stabilising addition to export income can be retained. It will be if Tonga is allowed to keep its present share of the New Zealand market.

Direction of Tongan Trade

The Director of Agriculture has tried to diversify exports further by developing a trade in peanuts and tapa cloth. After testing various seeds he succeeded in establishing a small production of peanuts and in disposing of them in New Zealand. Twelve tons were shipped in 1942 at the satisfactory price of £30 a ton. A strong local demand developed, however, with the arrival of Allied troops and killed this promising export trade. A market was found for tapa cloth in Britain which took forty-four tons in 1941 at a price of £20 a ton, but exports ceased when the spread of the War to the Pacific created insuperable

22: West M-3 (1846-1855) 1865 OU9 Tonga OU9

CHAPTER VI.

RICHNESS of the soil—Native method of manuring—Banana Plantations—Bread-fruit and native bread—Varieties of edible fruits—The Coffee-plant—The yam, and method of its cultivation—Other edible roots—Kitchen vegetables—The Cocoa-nut tree, and oil manufacture—English manufactory at Foa—Cotton-growing in Tonga—Native ideas of labour—Timber trees.

THE soil of the low islands is composed of a rich 134
black mould, with more or less of admixture with
sand, according to the distance from the sea. This
black mould, formed chiefly from decayed vegeta-
tion, ranges from three to six feet deep. In the
higher lands the soil varies from that of the black
mould to a tolerably stiff yellow and reddish clay.
Speaking generally, the arable soil rests either [133]
immediately upon the surface of a conglomerate
coral rock, or else upon an intervening stratum of
light clay and sand. Such is the natural fertility 242
of the land, and such also the rapidity with which [134]
vegetation grows and decays, under these tropical
skies, that the natives never think of employing
artificial means to improve the soil. They have,
nevertheless, a good knowledge of some of the best
principles of agricultural science. They understand 242
the necessity for a rotation of crops, and regularly 244
practise this in regard to yam plantations. At 245
suitable intervals they plant the yam grounds
plentifully with banana trees; by which plan
several great advantages are secured for succeeding
crops. The herbaceous nature of the trunk of this 245
tree, and the extent of surface presented by the 242
immense leaves, tend to accumulate and deposit a

22: West M-3 (1846-1855) 1865 OU9 Tonga OU9

245 vast amount of moisture in the soil during the
242 period of growth. In addition to which, no sooner has the fruit ripened, than the parent tree is cut down, and its juicy trunk and roots are left to rot upon the surface. The process of decay is rapid; and meantime the young sucker-plants, which spring up from every parent stem, reach maturity in swift succession, to be cut down in a similar manner. These banana plantations are allowed to remain during one or two seasons, after which the ground is replanted with other products,
(244) or with the yam. As a rule the yam is not replanted, in the same ground, until the lapse of two or even
242 three years. This system of resting the land, and
311 permitting the bananas to rot, unquestionably answers all the purposes of ordinary manuring; but it necessarily involves the occupation of a much larger quantity of land, than would be required, were the principles of European agriculture adopted.

245 Perhaps there is no sight more distinctively tropical than that of an extensive banana plantation. In these islands all the varieties of the tree flourish in highest perfection. The plantain, (*Musa sapientum*,) so greatly used and esteemed in the West Indies, is not much thought of by the Tonguese; but all the other sorts, included in the *Musa paradisiaca*, or banana family, are extensively cultivated. The fruit hangs in single bunches upon a strong stem issuing from among the leaves. Each bunch will weigh from thirty to even eighty pounds. The fruit is of various colours, and of great diversity of form, according to the description of tree planted. It is usually long and narrow, of a pale-yellow, or dark-red colour, with a yellow or

22: West M-3 (1846-1855) 1865 OU9 Tonga OU9

reckoned the following, which, being now well known, it is not necessary we should more minutely describe. Foremost is the bread-fruit. (*Artocarpus incisa.*) Of this fruit there are said to be at least fifty varieties. Those common to Tonga are known under the generic name of *Mei*, with distinctive appellatives attached to that word descriptive of the different kinds. This fruit, in addition to being eaten, cooked in the usual native fashion, either boiled or baked, is also made into *ma* or bread. The fruit is beaten up, and incorporated with the sweet banana, and scraped cocoa-nut. It is then divided into small balls, or portions, which are buried in a large mass underground, there to undergo fermentation. The *ma* is left buried for many months, after which it is fit for food, and will keep, if not exposed to the air, for a long time. When the *ma*-pit is opened, a very strong and disagreeable odour gives intimation of the fact, to a considerable distance: while the bread itself, to a European palate, is even less acceptable than the black bread of Russia. In taste it resembles what a mixture of barley-bread and rotten cheese might be supposed to be. It is nevertheless very nutritive, and is a good resource in seasons of famine, and in times of war.

The papaw-apple, (*Carica papaya,*) or *oliji*, abounds. There are also great quantities of shaddocks, oranges, limes, citrons, and lemons, all of which are included in the general name of *Moli*.

Several sorts of pine-apple grow in the highest perfection and abundance. They require no particular care in their cultivation; and, the ground being so rich, the suckers need not be removed, but may be allowed to run to fruit as well as the parent plant.

22: West M-3 (1846-1855) 1865 OU9 Tonga OU9

be impossible to depict the air of utter disappointment, mingled with lingering incredulity, which the woman's face betrayed, when a large canister of coffee-beans was placed before her, accompanied by an explanation of their true value. Upon inquiry, we learnt that she, and her wise lord at home, having heard of the new and valuable plant, secretly obtained one, and after tending it carefully, they thought to make a good thing of it, by taking its first fruits for sale to the Missionary. Considering the poor woman's ignorance, as well as her simplicity, and also the blank disappointment that met her, after such a long journey, we gave her a small present, as an encouragement to further cultivation of the plant, but sent her home with wonderfully altered ideas respecting the costliness of the coffee-bean.

The yam, or native *ufi*, (*Dioscorea alata*,) includes a great variety of this most valuable of all the edible roots of the tropics. It is the chief article of vegetable diet raised by the Tonguese; and, probably, it is cultivated in no other region to such high perfection or in such quantity.

The Tonguese do not believe at all in the Fijian practice of putting yam settings into hard and unprepared soil; nor, indeed, are the Fijians themselves uniform in their mode of cultivating the root. The plan adopted in Tonga involves great care and labour, but is rewarded by large crops of the most valuable esculent root to be found in the world.

After the surface of the ground has been thoroughly cleared of bush and weeds, the first part of the operation is that of digging the yam-pits, or *bukes*. These are dug of a diameter

22: West M-3 (1846-1855) 1865 OU9 Tonga OU9

244 of from two to four feet, and are from three to seven feet in depth, according to the kind of yam planted. The earth is dug completely out of these [412] pits, by the aid of small iron *huos*, or narrow lance-shaped spades, attached to a long wooden handle; and when the required depth has been reached, the loosened and pulverized earth is returned to the pit. This is done to permit the easy and rapid growth and expansion of the yam roots, which shoot downward like huge carrots. The pits are placed at equal distances from each other of about two or three feet, arranged in rows, and in the alternating order of the squares of a chess-board. Meantime, the settings have been prepared by slicing ripe old yams into pieces, varying from two to four inches in thickness. These are buried for a few weeks, until the vital portions of the yam have begun to sprout. This plan is necessary, because there are no eyes, or bud-marks, on the skin of the yam, such as are found in potatoes and other edible roots. Having sprouted, the good and vigorous settings are taken to be placed in the top of the yam-pits, at a depth of about three or four inches. When the vine has sprung up and begins to spread, it must be very carefully and constantly cleared of weeds, and must also be protected, as much as possible, from the effects of high winds. If the vine be damaged, the yam-root suffers in proportion; and should it be destroyed, by being choked with weeds, withered by the sun, or torn by the wind, the root beneath speedily perishes. The operation of the *ututa'u*, (the Tonguese harvest,) or raising the yams, when fully ripe, is even more laborious and difficult than that of the first preparation of the pits. To get them out of

22: West M-3 (1846-1855) 1865 OU9 Tonga OU9

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the ground, these must be carefully opened, and the earth be removed from around each individual root. Thus, when these have shot down to a depth of five or six feet, as is the case with the larger sorts, the toil in lifting them safely out of the ground becomes very considerable. Owing, also, to the fact that any cut, or abrasure of the skin of the yam, soon causes it to rot, all the more care and skill become necessary, in removing the roots from the soil. The settings very rarely produce more than three roots in each pit. To raise, therefore, the large quantity of yams necessary for the consumption of the people, as well as the supply of foreign vessels, very extensive tracts of country are put under cultivation. The visitor can pass through no district of the islands without observing, on every hand, the fruits of native industry, in the well-kept and large yam plantations, of which they are justly proud.

There are many varieties of the yam, but the Tonguese are remarkably nice in rejecting inferior sorts. The *ufilei*, or sweet yam, being both small and insipid, is not much cultivated. The best are the *tuas*, *kahokahos*, *kaumeles*, and *kivis*. All these sorts are dry and mealy, when properly cooked; and are far superior in flavour to the best of our potatoes. Single yams vary greatly in size, and in weight, ranging from seven to eighty pounds, according to the species. Yams of from sixty to eighty pounds' weight, are by no means uncommon.

Other edible roots, that are greatly liked and cultivated in the Society Islands, and elsewhere in the Pacific, are but lightly regarded by the Ton-

22: West M-3 (1846-1855) 1865 OU9 Tonga OU9

244 guese. Among these may be reckoned the *kumala*, or sweet potato, (*Convolvulus batatas*,) and the *talo*, or *arum*, of botanists. Both are grown; but the former is considered to be a very vulgar substitute for the yam; while the latter requires such marshy land for its perfect success, that only a very few spots are found suitable for it in the Friendly group. The common potato has been tried by the Missionaries, and thrives pretty well in favourable situations. The potatoes, however, soon degenerate in size and flavour, so that a renewal of imported seed becomes necessary every second or third year. It would, no doubt, do better if cultivated only on the higher lands of Vavau, and in similar localities.

797 137

244 There are several species of the *ji*, (*Dracæna*,) and from one of these a large root is obtained, [263] which, when baked, yields a considerable quantity [262] of brown saccharine liquid, sometimes used in sweetening native puddings; while the stringy substance of the root itself is eaten, and resembles somewhat in taste the sweetness of stick cinnamon. [231] The leaves of the different sorts of *ji* afford capital fodder for goats, sheep, and cattle.

824 The arrowroot plant, (*Tacca pinnatifida*,) grows [244] wild, and is found in quantities sufficient to meet the wants of the people, without any special care being devoted to its cultivation. The chief use of the starch, obtained from it by the natives, is in the manufacture of their *gatu*, or cloth. The various [287] small stripes of *fetaaki*, or beaten bark, of which the cloth is made, are joined together by means of arrowroot paste. Any quantity, however, of the root could be raised with but little outlay or labour; and when a better method of scraping and

22: West M-3 (1846-1855) 1865 OU9 Tonga OU9

America, the plant will be a valuable accession to the edible resources of the people.

In kitchen vegetables there is no great variety. The natives have been accustomed to use several esculent leaves, to which foreigners have added cabbages, some excellent descriptions of pumpkin, and the vegetable marrow. This latter was first taken to the islands by the late Sir Everard Home, of Her Majesty's Royal Navy. All these grow readily, attain a large size, and are of good quality. Cucumbers, carrots, radishes, parsley, and turnips, have also been raised, and will no doubt succeed well in proper localities, and will become abundant. Their culture, however, thus far, has been confined, almost entirely, to the gardens of foreign residents.

The truth is, the natives are firm believers in the supremacy of the favourite yam over all other vegetables whatsoever; and to that, therefore, they devote the greater part of their time and skill. In this opinion and course they are quite correct, because the yam is to them the chief "staff of life." Anything, therefore, that would diminish the cultivation of the yam, would soon prove a serious calamity to the people. At the same time there is plenty of scope for the further introduction, and large cultivation, of various foreign products; all of which will add materially to the wealth and comfort of the inhabitants.

Of the cocoa-nut tree we have hitherto said nothing; but this tree, and its fruit, are unquestionably the most abundant, and characteristic, of the country. Whole forests of these beautiful palms flourish in all the islands, whether large or small. In those that are of moderately high elevation they crown the hill-tops and sides, while in every

31· Nayacakalou E-4,5 (1957-1958) 1959
OU9 Tonga OU9

This sample is too small, but for what it is worth in the absence of a larger sample, the correlation coefficients between labour and production and between land and production suggest that money income varies more readily with the quantity of labour available than with the amount of land; i.e. a man is more likely to obtain a greater income by working harder than by increasing his land holding.[27] Uneven as it is, therefore, the distribution of land exerts only a minimal influence upon the amount of money obtained. This may partly explain why an uneven distribution of land tends to be left undisturbed; but this latter tendency may be tolerable only at the present level of economic development and may tend to disappear at a higher level.

6—Land Use and Labour

The legal provision relating to the planting of coconuts at intervals of 30 feet is, by and large, followed consistently on the majority of the *api* I have seen. Amongst the coconut trees there would be food and cash crops of several types, bananas, taro, yams, sweet potatoes, *manioke*, and even pineapples and water melons. In general, these are not planted in sharply defined plots but are interspersed one amongst the others, so that in an intensively cultivated *api*, members of all species would be found on each square chain of ground. This is more or less the general pattern, although there may be varying degrees of emphasis upon particular crops in particular parts of the *api*. Varying the pattern of emphasis would appear to me to play a similar role to straight out rotation.

The coconut trees belong to the planter but are heritable with the land on his death or secession; and as their normal productive life is 50 or 60 years, they may change hands several times during their lifetime.[28] But the other crops, requiring from three to eighteen months to mature, are the property of the planter, whether he be the legal holder of the land or not.

The distinction between permanent and annual crops makes it easier to understand all the sharing of *api* referred to in the previous section. For while the current holder of an *api* owns the coconut trees and other permanent resources, he need not have the whole *api* under the less permanent crops at any one time.[29] This gives him room to permit a friend or relative to plant for himself a crop of taro or yams

[27] My calculations produced correlation coefficients of r = .32 and r = .54 for land and labour respectively.

[28] The evidence of the 107 *api* which I studied shows that several of them had changed hands twice or thrice in the previous five or six years.

[29] The Beagleholes quote a man who estimated that up to twenty cultivators and their families can live off one *api*, Beaglehole 1941:18, but it is not clear whether this refers to an ordinary *api* of 8¼ acres or to one of the larger ones which may be up to 20 acres in area, Beaglehole 1941:17. In this connection it may be interesting to note that in a village of about twenty households which I studied in Fiji, the total area covered by food crops in various stages of development was found by detailed measurement to be 8.1 acres for all households.

43: Maude K-4,5 (1962) 1970
OU9 Tonga OU9

cannot be explained by variations in land quality. Climatic and soil conditions in Ha'apai do not seem dissimilar to those in Tongatapu, although in Ha'apai the less valuable *tou'one* soil type occupies a greater proportion of the total land area than in Tongatapu; neither is there any evidence to suggest that land in western Tongatapu is inherently more productive than land in eastern Tongatapu. The main explanation appears to lie in the relationship between settlement and marine resources. Seafoods have always been valued items in the Tongan diet, although fishing and reef-collecting have declined in recent years as canned meat and fish have become more easily obtainable. Village settlement therefore tended to concentrate where there was a good balance between the resources of the land and the sea. Where shores and reefs were productive but the land area limited, as in the small islands of Ha'apai and the narrow western point of Tongatapu, population densities were higher than where productive shores were backed by more extensive land areas, as in central and eastern Tongatapu, or where unproductive shores limited village settlement, as along part of the south coast of Tongatapu. The population growth of the present century has quickly brought problems of land shortage to the former areas.

THE AGRICULTURAL SYSTEM

The basis of present Tongan agriculture is a bush fallowing system for the cultivation of tubers, the term *bush fallowing* being used to denote a form of shifting cultivation in which the fallow period is short (Morgan, 1959; Watters, 1960.)

The agricultural cycle begins with the selection of a plot for clearing, burning and planting, the selection being based on the requirements of the crop to be grown and the land available to the gardener. Tongans judge land by the type of soil, by the growth of vegetation and by their previous experience in cropping, but because of land shortage and the system of land tenure the area available to choose from is limited, despite the common practice of borrowing the use of land. Where the soil is considered to be sufficiently fertile a yam patch (*ma'ala*) begins the cropping sequence, and most

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gardeners try to plant one and sometimes two *ma'ala* a year. Giant taro (*Alocasia macrorrhiza*) and/or plantains and bananas are usually planted with the yam (*Dioscorea alata*), in rows 12 to 18 feet apart. In the more densely populated areas taro (*Colocasia esculenta*) is often inter-planted in the same plot, but in central and eastern Tongatapu this practice appears less common. When the yam is harvested it is replaced with taro, sweet potato or cassava. Taro is harvested as needed and as the tubers are dug the stems may be replanted for a second crop. Cassava may also be replanted one or more times, up to five successive crops being taken before the land is rested. The cropping sequence may sometimes end with plantains and bananas rather than tubers, with the former crops being inter-planted with the last crops of taro or cassava and being left on the land when these are harvested. Apart from yams, sweet potatoes may also begin a cycle of cropping. They are usually the first crop on sandy *tou'one* soils and are frequently grown on newly cleared land in the grassy areas of central Tongatapu. The next crop is then generally cassava, and bananas and plantains may be grown with the tubers.

Although definite but flexible patterns of crop succession and crop association (or inter-cropping) can be distinguished, the value of these is uncertain. Inter-cropping as practised in Tonga probably has some advantages. The growing of a variety of crops together provides a better cover for the soil, and consequently protection from sun and rain; the labour needs for weeding are also reduced. Different crops make different demands on the soil, and inter-cropping may therefore be a more efficient way of utilizing a garden area. On the other hand the patterns of crop succession appear to be related more to the requirements of the various crops than to any attempt to develop rotations which conserve soil fertility, and the basic crops which are rotated are all tubers, with the exception of bananas and plaintains. Yams are planted first because they require a loose soil well supplied with plant nutrients, conditions best found in land newly cleared from bush, while sweet potatoes, taro and cassava are less demanding and can be planted on land

[p. 59-A]

already cropped. Sweet potatoes do better on lighter or less fertile soils, which do not promote excessive leaf growth at the expense of tubers, while taro is generally grown on heavier soils. Cassava can be grown practically anywhere, and because it yields well even on poor soils is frequently last in the cropping sequence. 244

After a cropping period of from two to about five years the plot is bush fallowed. The cessation of gardening, however, is often gradual as taro, cassava, bananas or plantains may remain on the land and continue to be harvested for one or more years after cultivation of the plot has ceased, a practice which is not uncommon amongst shifting cultivators (Webster & Wilson, 1966). Taro may also be planted and left in the ground as a reserve against future needs. [245]

Some cash crops are grown as an integral part of the bush fallow system. Bananas, for example, are frequently planted as part of the cropping sequence and yield for only a few years before the land returns to bush. At present, however, with the very marked growth in banana exports over the last few years bananas increasingly are being grown in separate plantations, though often with some inter-cropping of food plants, and chemical fertilizers are being much more extensively used both to improve yields and to extend the life of the plantation. Watermelons are another, but minor, cash crop grown by the bush fallow system, as the first and sometimes the only crop planted on newly cleared land. 241 245 245 439 242 244

Coconuts, on the other hand, as a long-term tree crop, are not cultivated as part of the bush fallow system, but are unevenly scattered over part or all of each allotment. Most farmers prefer to keep part of their land free of coconuts, because they say that the shade cast by the palms lowers the yields of the crops grown under them, and in the past a common practice was to plant half of an eight and a quarter acre allotment in coconuts and leave the remainder fairly clear. Particularly in Ha'apai, however, those with small allotments (around three to five acres) have found it necessary to plant all their land to ensure a reasonable cash income. Consequently the Tongan farmer now rotates his gardens around 245 245 241

[p. 59-B]

43: Maude K-4,5 (1962) 1970
OU9 Tonga OU9

farming, instancing reductions in the fallow of from four to five years down to two to three years and from three to four years down to one to two years. Furthermore, in Ha'apai the fallowed land is more likely to include scattered crops of cassava or taro, for some farmers have a type of combined cropping and fallow period in which the grasses and other herbaceous plants of the fallow regrowth are left unweeded around the crop, except when part of the crop is harvested and replanted. Farmers claim that both the fallow growth and the cassava help to restore the fertility of the soil, and that when the plot is finally cleared and harvested, after perhaps two years, it can be planted immediately in yams. This is a more intensive development of the common practice of leaving some crops on the land after cultivation of the plot has ceased, for the crops are often replanted while the plot is under bush fallow growth and cropping continues during the whole of the fallow period.

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In Ha'apai and western Tongatapu land shortage has led to most allotments being completely planted in coconuts, although often with a fairly open spacing of the palms. In the village of Holopeka, for example, only one garden was found in which an area, no more than an acre, had been left clear of coconuts.

241 245 182

[p. 61-B]

There are also significant differences in the food crop pattern between areas of high and low population density. In areas of high population density cassava becomes the staple food crop and yams are less frequently grown, despite the fact that cassava, which was only introduced into Tonga in the nineteenth century, has a low status as a food and yam is the prestige tuber. With the widespread planting of coconuts and the shorter fallows which have resulted from the increasing pressure on the land farmers complain that there is now less land suitable for yam growing, and many are unable to afford the long fallows considered necessary to produce the right soil conditions for the tuber. Cassava, on the other hand, is easy to cultivate, is more resistant to drought than the other staples available, gives good yields even on heavily cropped soils, and does not require a lengthy fallow. In Ha'apai it is not unusual to find plots which have been cropped with cassava for four or five years in succession. Dryland varieties of taro have also increased in popularity because they can be replanted several times, and like cassava were introduced into Tonga only in the nineteenth century.

241 182 241 182 244 [245]

The reaction to population growth has therefore involved a reduction in the fallow period, a lengthen-

241 182 245

[p. 64c]

47: Decktor Korn E-5 (1969-1970) 1975 OU9 Tonga OU9
Tongatapu
Motulahi

village had no one engaged in any income-producing activity besides the basic Tongan pattern of peasant production. In the remaining households, there were a total of 54 government employees, both men and women, almost all of whom worked in the main town. In addition, there were persons employed outside government (mainly as laborers in various enterprises), or by one of the churches (usually as teachers in a church-run school). Besides people with jobs, there were people in the village who had business enterprises of their own. Included in this were six stores in the village, two women kept large flocks of chickens and sold the eggs to the big stores in the main town, there were three privately owned sheds that were hired for movies and dances or used as copra-weighing stations, two men owned trucks for hire, one man operated a band, a woman had a dress-making shop in town, and so on. Other income-producing activities of people in the village included the cultivation of watermelons (mainly for export to New Zealand) and the manufacture of handicrafts.

In many cases, the income-producing activities described here were not full-time occupations, nor were they the major source of income for the household. In most of the households in the village, subsistence production and copra production are the mainstay of the household, while other income-producing activities serve mainly to provide a more or less steady flow of cash. On the other hand, households with no source of supplementary income enjoy a noticeably lower standard of livjng. Among these, for example, there is a greater proportion of the old-style, coconut-thatch houses or old and shabby wooden houses—people without supplemental sources of cash income find it more difficult to obtain the large amount of cash needed to build a new wooden or brick house.

The major part of the everyday cash requirements and other material needs of a household are provided for if the household has access to an agricultural allotment (*'api 'uta*). Although this is not the place to describe the Tongan system of land tenure in any detail,[11] the following notes will suffice to indicate the major elements involved in a household's having access to an allotment. In theory, every male over the age of 15 is entitled to an agricultural allotment of 8¼ acres registered in his name. In practice, however, about 60% of all who are eligible do *not* have land in their names (largely because of shortages stemming from the pressure of increasing population). Some men, on the other hand, have effective control over more than one allotment,

11 For articles dealing with the system of land tenure, see Maude (1972) and Nayacakalou (1959). In addition, refer to Rogers (1969) for a discussion of the *Report on the Results of the 1966 Census* (Fiefia 1968) that focuses on the findings relating to population increase and its effects on land holding.

55: Anderson D,T-5 (1777) 1967 OU9 Tonga OU9

is of a steep rugged coral rock nine or ten feet high, except the two sandy beaches already mentioned, which have a reef of rock extended from across their entrance to the shore and defends them from the sea. They make excellent harbours for boats but it is difficult to get in at low water, though at that time it is easy landing on the rocky shore without if the weather is moderate. On the SE side, which the Master examin'd is a fine sandy beach with good anchoring & landing, but it is expos'd to the ESE wind which blows almost constantly and sometimes pretty fresh, from whence it can scarcely be preferable to our anchoring place, the best part of which seems just to the W^ward of the largest sandy beach, as appear'd from the Discovery lying foul by being a little the other way. In the centre of the isle is a large Salt lake about a mile & a half across, round which the land rises like a bank with a gradual ascent; but we could not see any communication it has with the sea, though from the low land that runs across to it from the largest sandy Beach and the sandy soil it would appear it may have once communicated that way. There is another lake or pond, but much smaller, a little way from the shore on the left hand of the sandy beach from which we took our water, and though brackish may if taken up after rain (a great deal of which luckily happened just before our arrival) answer the purposes of a ship sufficiently. The soil on the rising parts of the island & especially towards the sea is of a reddish clayey disposition or a black loose mould, but there is no other water than the pool already mentioned, except in some small holes dug by the natives near the last which afford much better water than the pool itself.

It is very well cultivated except in a few places, and there are some others which appear to lye waste but are only left to recover the strength exhausted by constant culture, for we have seen them frequently breaking in these spots to plant again. The plantations consist chiefly of Yams and plantanes, many of which are very extensive and often inclos'd with neat fences of reed dispos'd obliquely across each other about six feet high. Within these are frequently seen other fences of less compass which surround the houses of the principal people, but for the most part these are found

can compare high land, and shall therefore say that it is the next in degree whether with respect to the whole body of land being high or its being interspers'd with high hills. Very high or mountainous land cannot be easily comprehended in a single definition, but may be understood by its always exceeding the other & adding some particular description of its height.

It should be observd that the criterion of low land mention'd above can hardly be applied to Annamooka and some of the isles about it, but I have consideri them as low merely to avoid confusion, as they cannot be admitted to the rank of those of a moderate height which we have yet seen, as Wateeoo & Mang'ya.

A [of Nomuka--Analyst]

55: Anderson D,T-5 (1777) 1967 0U9 Tonga 0U9

in the open plantane fields. The bread fruit and Cocoa nut trees are interspers'd with little order though chiefly near their habitations, and the other parts of the island, especially towards the sea and about the sides of the lake are coverd with trees and bushes of a most luxuriant growth, the last place having a great many mangroves & the first a vast number of the Fait'anoo trees already mentioned. There seems to be no rock or stones of any kind about the island that is not coral, except in one place to the right of the sandy beach which is the highest part of it, where there is a rock twenty or thirty feet high of a calcareous stone of a yellowish colour and a very close hard texture, but even about this place are large pieces of the same coral rock that composes the shore.

We liv'd on the most friendly terms with the natives while we remain'd here, and obtain'd a much larger supply of refreshment than could have been expected from so small a place, but it should be consider'd that all the small islands around it furnish'd their Quota, and the strangers that brought their hogs and other things were oblig'd to live in temporary huts which they erected or lay themselves down behind bushes or ferns. Besides walking frequently in the country, which we were permitted to do without any interruption, we sometimes amus'd ourselves in shooting wild ducks not unlike the Widgeon[1] which are very numerous upon the salt lake and the other pool. In these excursions we found the people had often deserted their houses to come down to the trading place without entertaining any suspicion that strangers rambling about would take away or destroy any thing about them, but though in these cases it might be suppos'd a great part of the inhabitants were sometimes collected at the beach it was impossible to form any true computation of their numbers, as the continual resort of strangers from other places mixing with them might easily mislead one. However as there was never to appearance above a thousand seen at one time it would perhaps be sufficient to allow double that number for the whole island.

We steerd about NNW towards Káò and Toofôá in our way to Hapaee,[2] an island which Fee'nou said was of a considerable extent, where we could be supply'd plentifully with every refreshment in the easiest manner. He engag'd to go to this place with us himself and seem'd to have some interest in it, for he express'd a good deal of aversion to the Captains intention of going to Amsterdam which he mention'd to him. Although they made us understand that Hapaee lay rather to the NE of Anna'mooka, we were obligd to take this route because there is a cluster of islands lying between Annamooka &

[1] *Anas superciliosa.* [2] Ha'apai.

A [Nomuka--Analyst]

55: Anderson D,T-5 (1777) 1967 OU9 Tonga OU9

Poulaho to be King of Amsterdam & the other isles but seem'd to insist very much upon it, perhaps from a fear of offending the other when he should hear of his former presumption.

The inhabitants have been very busy in cultivating while we were absent for they have made several large Plantane fields in places that were waste at first. We observ'd here as well as at Kotoo a good many of the small hillocks where the Yams are planted strew'd with a little white sand, which they say are those intended for the use of the chief. The Melons which the Captn sow'd here have come up but are mostly eat by small insects & some of the Pine apples left with Toobou seem to be in a thriving state.

SATURDAY 7th. The wind ENE. Fresh breezes with fine clear weather. In the forenoon Poulaho came from Kotoo and we could at once see his superiority to Feenou on meeting him, for the last plac'd himself down in the circle that sat before Poulaho as an indifferent person. He seem'd at first rather abash'd as some of us were present who had been us'd to see him as a different person, but he soon recover'd himself & both he and Poulaho went on board with the Captain. He behav'd there much as any of the others that attended Poulaho, saluting his foot with his head and hands and could not ther[e] eat nor drink before him.

A few Canoes came off to the ship but we had less trade on shore than yesterday as most of the people went away when Poulaho landed.

Some of the Indians stole three glasses belonging to the Astronomical Quadrant while Mr King was observing on the beach, but they were soon recoverd by applying to Feenou who had been very usefull to us before when things were stole both here and at Ha'pace.

SUNDAY 8th. The wind ENE and NE. Moderate breezes but at night rather gentle. The weather fine. A moderate sea. Between eight and nine in the morning we weigh'd and left Annamooka steering sbw for the island Amsterdam. The islands to the SE of Annamooka which we had on our left are first Mango'eeke, Mango, Tonoo'maia, Ko'noogoo and Falla'fa'jeea.[1] There is also a very small one off Kon'oogoo call'd Gefoo'ganna[2] from which runs a large shoal nam'd Ko'foonga'lillo.[3] In the evening between five and six we saw two islets or rocks bearing w about four leagues, the Nºermost call'd Hoonga ha'pace and the other Hoonga'tonga.[4] The first has only five

[1] Kelefesia.
[2] I cannot identify this shoal.
[3] Kefikana, a conspicuous white rock.
[4] Hunga Ha'apai and Hunga Tonga.

55: Anderson D,T-5 (1777) 1967 OU9 Tonga OU9

height, and when broken off appears sometimes of a reddish though oftener of a brownish yellow colour & pretty stiff consistence. Where the shore is low the soil is commonly sandy or rather composd of triturated coral, which however yields bushes with great luxuriance and is sometimes planted not unsuccessfully by the natives.

Of cultivated fruits the principal are Plantanes of which they have eighteen different sorts or varieties, Bread fruit, Jambos,[1] a sort of plumb mention'd in Captn Cooks account of Otaheite call'd E'eevee,[2] and vast numbers of Shaddocks[3] which however are found as often in a natural state as planted. The roots are yams, of which are two sorts, one black & so large that they often weigh twenty and thirty pound,[4] the other white and long seldom weighing a pound;[5] a large root call'd Kappe,[6] one not unlike our white Potatoes call'd Ma'whaha,[7] the Talo or Coccos[8] of other places and another nam'd Jeejee.[9] Besides vast numbers of Cocoa nut trees they have three other sorts of palms two of which are very scarce. One of them is call'd Beeoo, which grows almost as high as the Cocoa tree, has very large leaves plaited like a fan, and clusters or bunches of globular nuts not larger than a small pistol ball growing amongst the branches with a very hard kernel which is sometimes ate.[10] The other is a kind of Cabbage tree not distinguishable from the Cocoa but by being rather thicker and having its leaves more ragged. It has a Cabbage three or four feet long, at the top of which are the leaves and at the bottom the fruit, which is scarcely two inches long, resembling an oblong cocoa nut with an insipid tenacious kernel call'd by the natives Neeoo goola or red cocoa nut, as it assumes a reddish cast when ripe.[11] The third sort is calld Ongo ongo and much commoner, being generally found planted about their burying places. It seldom grows higher than five feet though sometimes to eight, and has a vast number of oval compress'd nuts as large as a pippin sticking immediately to the trunk amongst the leaves which are not ate.[12] There is plenty of excellent sugar Cane which is cultivated, Gourds, Bamboo, Turmeric, and a species of fig about the size of a small cherry calld Matte, which though wild is sometimes ate;[13] but the Catalogue of uncultivated plants is too large to be ennumerated here, especially as the

[1] *Eugenia malaccensis.* [2] Vi, *Spondias dulcis.* [3] *Citrus decumana.*

[4] *Dioscorea alata*, though the tubers are generally brown on the outside rather than black. They sometimes grow to an enormous size, 6 to 8 feet long, and weigh much more than 30 lb.

[5] ? *Dioscorea bulbifera*, the wild yam. [6] The Giant Taro, *Alocasia macrorrhyza.*

[7] Mahoa'a, *Tacca leontopetaloides.* [8] Taro, *Colocasia antiquorum.*

[9] Si, *Cordyline terminalis.* [10] Piu, *Pritchardia pacifica.*

[11] It was a sort of coconut: Niu kula, *Cocos nucifera* ssp.

[12] It is called Longo-longo by the modern Tongans: *Cycas circinalis.*

[13] Modern Masi, *Ficus tinctoria.*

67: Maude K-5 (1961) 1973 0U9 Tonga 0U9

from one to ten or more years, depending on population density. Of the two main cash crops bananas are often incorporated into this bush fallow system, being planted as part of the cropping sequence and yielding for only a couple of years before the land returns to bush; but during the last few years they have increasingly been grown in separate plantations, and chemical fertilizers are now being used both to improve yields and to extend the life of the plot. The other main cash crop, coconuts, is unevenly scattered over all or part of each allotment, with the food-crop gardens being rotated amongst them. The effect of population density on this system will be examined from two perspectives, the ecological and the economic.

An ecological assessment

In Ha'apai, where the agricultural system is under the greatest pressure from high population density, the cropping period is now usually from three to five years, compared with the two or three years common elsewhere, while the fallow period is generally from only one to three or four years compared with three to five years elsewhere. Many farmers in Ha'apai are using shorter fallows than when they began farming, a common change reported amongst older men being a reduction to half the earlier fallow length. The food-crop pattern has also changed with the increase in population density. In areas of high density, cassava has become the staple food crop while yams, the most preferred tuber for eating, are now much less frequently grown. Cassava gives good yields even on heavily-cropped soils and does not require a lengthy fallow, and also yields more per man-hour of labour than the other food crops.

The response of Tongan farmers to population growth has therefore been to reduce fallow periods, lengthen cropping periods and alter the food-crop pattern, and these changes are most pronounced in Ha'apai. There the agricultural system is now fairly intensive by the standards of shifting cultivation, with a cropping period/fallow period ratio of around 1 : 1, and supports population densities of up to about 280/km² (cf. Nye and Greenland, 1960, 128). Yet despite the probable doubling in the intensity of cropping over the last 30 to 40 years there has been no change in the bush fallow technique of maintaining soil fertility, and one might therefore expect to find symptoms of ecological stress within the system.

An examination of possible areas of stress, however, suggests the existence of as yet only minor problems. There has been some

[440 cont.]

175 by it in the most shocking manner; there was only a hole left in the
164 place of her nose; her cheeks were swelled up and continually
oozing out a purulent matter; and her eyes seemed ready to fall out
[439] of her head, being bloody and sore. These were some of the most
miserable objects I recollect ever to have seen; and yet they seemed
to be quite unconcerned about their misfortunes, traded as briskly
as any of the rest, and what was most nauseous, had provisions to
sell.

175 After dinner Dr. Sparrman remained on board with me, in order
122 to arrange our acquisitions of the morning, and my father again
[126] accompanied the captains to the shore, with a view to collect a fresh
supply. They returned about sunset, and my father gave the following
account of this excursion.

175 "At the landing-place the natives welcomed us with shouts as in
439 the morning, and the croud being as numerous as ever, the trade was
carried on very briskly, but provisions were scarce, and shaddocks in
particular not at all to be had, as the season was not yet sufficiently
175 advanced. Mr. Hodges, myself, and one servant, left the trading-place with
123 [441]two of the natives, whom we engaged to become our guides in
case of necessity, and walked up the hill to view the interior part
175 of the country. Our walk lay through a number of rich plantations or
311 gardens, enclosed as before mentioned with fences of reeds, or with
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197 quick-hedges of the beautiful coral flower, (erythrina corallodendron.)
175 Beyond these we entered into a lane between two enclosures, and
311 observed bananas and yams planted in rows on both sides, with as much
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[244] order and regularity as we employ in our agriculture. This lane
[245] opened into a fine extensive plain, covered with rich grasses. Having

175 [448 cont.]
311 part of it appeared to have been planted
[244] with yams, but the rest was full of grass, and had a little swamp
[133] in the middle, where the purple water-hen, of poule sultane,
[136] resided in great numbers. As soon as we left this, we entered into
[487] a lane about six feet wide, between two fences of reed, which
[417] enclosed extensive plantations on each side. Here we met many of
[609] the natives, who were traveling to the beach with loads of
[201] provisions, and courteously bowed their heads as they passed by us
in sign of friendship, generally pronouncing some monosyllable or
175 [449] other, which seemed to correspond to the Taheitian tayo. The
351 enclosures, plantations, and houses were exactly in the same style
184 as at Ea-oowhe, and the people had never failed to plant odoriferous
175 shrubs round their dwellings. The mulberry, of which the bark is
137 manufactured into cloth, and the bread-tree, were more scarce than
at the Society Isles, and the apple of those islands was entirely
unknown, but the shaddock well supplied its place. The season of
spring, which revived the face of all nature, adorning every plant
with blossoms, and inspiring with joyful songs the feathered
tribe, doubtless contributed in a great measure to make every object
175 pleasing in our eyes. But the industry and elegance of the natives,
311 which they displayed in planting every piece of ground to the greatest
181 advantage, as well as in the neatness and regularity of all their
works, demanded our admiration, whilst it gave us room to suppose,
that they enjoyed a considerable degree of happiness.

175 One of the lanes between the enclosures led us to a little grove,
137 which we admired for its irregularity. An immense casuarina tree
[136] far out-topped the rest, and its branches were loaded with a vast
number of blackish creatures, which we took for crows at a distance,

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651 ceremony which involved the presentation of produce and material goods
796 at certain times of the year. An ethnographic reconstruction of the
[121] Tongan ceremony can serve as a test of Sahlins and Goldman and can also contribute to ethnological comparisons in Polynesia.

244 The Tongans were a horticultural people and the yam, or 'ufi,
262 was the main crop. The Wesleyan missionary Cross stated "the yam is a vegetable that is to the inhabitants of Tonga, what bread is to many in our native land" (Cross, Letter-Journal entry of December 3, 1830).
805 The aboriginal Tongan names of the respective parts of the year, based
244 on the lunar month and thirteen separate designated time periods (Dyson, Journal, April 7, 1863), indicate the importance of the yam to the Tongans. Thomas wrote that the month of June was termed "Hilinga kelekele" by the Tongans and that "they expect the soil to produce forth now" (Thomas, MS. A1959: n.p.). He also wrote that the Tongans "expect the soil to produce forth now" and of the yams of this time period, that "this is the earliest and the best yams" (ibid.). For the European month of October, Thomas wrote: "Ooloo anga - Uluega" which is 'Uluenga for "Ooloo, the head, anga yellow" and at this time the yams "become yellow" (ibid.).

127 Reading and extracting descriptions by the ethnohistorical
797 chronological-synchronous reading method reveals the changes in the
796 individual missionary's reporting capabilities. These changes of the
651 observer to the observed are evident in the examples from Thomas' manuscript accounts describing the 'inasi, transcribed by Thomas as "inache" and "inaji." The first example is from Thomas' 1826 journal, when he

127 ceremony; but they were not confined to yams: Toku Island, approxi-
651 mately 220 miles from Tongatapu, sent "the young of a sea bird" and
796 the island of Nomuka, approximately 70 miles from Tongatapu, "sent fish from the sacred lake [which was] carefully prepared" (Ibid.) for the ceremony.

With the above evidence, preliminary statements of ethnohistorical facts might be: islands furthest from Tongatapu sent imperishables to the 'Inasi ceremony, even though certain Polynesian foodstuffs (including yams) do travel well for lengthy distances; or, Uvea and Niua Fo'ou sent items which were unusual at Tongatapu, or items "of superior kind."

The 'Inasi ceremony, then, involved more than presentation of foodstuffs and as Mariner, a non-missionary, pointed out, it was a
127 "certain public ceremony of a religious nature." Aboriginal Tongan
651 religious beliefs were an important part of the ceremony since when
796 the Tu'i Tonga was present, the products were presented to him, and
643 when he was not, they were presented in his absence to the gods. Thomas
[776] wrote of the Tu'i Tonga that he was:

> viewed as the representative of the god Hikuleo, a kind of connecting link therefore between the people, and the god and his place was at Olotele [on the island of Tongatapu] [stress added] (Thomas MS. IA: 252).

127 There were two yearly 'Inasi ceremonies, the 'Inasi 'ufimui and the
651 'Inasi 'ufimotu'a, and writing of the 'Inasi 'ufimui Thomas stated:
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> This was a solemn yearly gathering of chief and priests from all parts of Tonga, which took place at Mua [on Tongatapu Island] in the month of June, called Hiligakelekele, to present what we may term

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> the first fruits, or the first young yams to the god Hikuleo, at his house at Olotele, as an acknowledgement of their dependence upon him and the gods, as the owners of the earth, the sea, and all things and to unite to supplicate the gods, to bless the seed now about to be put into the ground, and to send them suitable weather of rain and sun, that the yams set may bring forth a crop, and that their labours may not be in vain (Thomas MS. 2: 262) [stress added].

This 'Inasi 'ufimui, held at the height of winter in the Southern Hemisphere, or in approximately June or July, was not only an acknowledgement of "the first young yams" and the crops which were being planted, but was also a "thanksgiving to the odooa," or 'otua named Hikuleo, "for the late ripe yams" (eyewitness' description-interpretation of events of July 25, 1797, in Wilson 1799: 259).

The 'Inasi-'ufimotu'a, derived from "'ufi-" and "motu'a" with the latter term meaning "mature" (Churchward 1959: 367), was held in approximately October-November. Thomas wrote that this was the acknowledgement "to show the prosperity of the land, that the old stock had lasted till the new were fit to dig up" (Thomas MS. 5: 19). The Wesleyan missionary Lawry's typescript diary has a description of the first 'Inasi he was eyewitness to on Tongatapu. Probably through the typist's error, the term is typed as "Hachee:"

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> The great ceremony of Hachee, one of the greatest festivals in Tonga, ceased to-day. It has continued nine days. Its object is to bring the first fruits of the earth and present them before the god who has sent them good yams. That part of the island were we live is called the Hooa, or metropolis of Tonga; and to this place the chiefs of Vavaou and the Hapais bring their machee, towards the end of the last moon the fleet of canoes and crowds of people by land rendering the Hooa a moving scene of universal bustle and stir. The ceremony lasts nine days. Every day has its special transaction [stress added] (Lawry, Diary, October 21, 1822).

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[244]

76: Yuncker N-4,5 (1953) 1959 0U9 Tonga 0U9

137 'Eua: ravine of Lakatoha River near Ohonua, Nov. 10, 1951, *Hürlimann 236;* same location, Apr. 2, 1953, *Yuncker 15613.*

Lifuka: climbing in shrubbery of seaside thicket, north of Pangai village, Apr. 24, 1953, *Yuncker 15704.*

Occasional to frequent in thickets throughout Tonga. A south African plant now widely disseminated in warm countries.

Tongan name: *taupo'ou.*

Genus **Smilax** Tournefort

Smilax vitiensis (Seemann) A. de Candolle, in DC. Monogr. Phanerog. 1: 204. 1878.

Rather slender, woody vine. Leaves alternate, round-ovate, abruptly short-pointed, base rounded, cordate, palmately 5-7-nerved, up to 15 cm. long and 15 cm. wide, petiole up to 5 cm. or more long, with a pair of stipular tendrils. Flowers greenish, on slender pedicels up to 2 cm. long, in axillary, pedunculate umbels, peduncle up to 8 cm. or more long.

'Eua: climbing in trees, forest above Fuai plantation, near center of island, Mar. 21, 1953, *Yuncker 15401;* in forest on seaward terrace along trail descending to Lokupo, Mar. 27, 1953, *Yuncker 15512.*

Occasional on 'Eua. Also in Fiji.

Tongan name: *matafu'i.*

[244] [824] [247] The cultivated garden asparagus (*Asparagus officinalis* Linnaeus var. *altilis* Linnaeus), onions (*Allium cepa* Linnaeus), and leeks (*Allium porrum* Linnaeus) are occasionally cultivated as vegetables. *Eucharis grandiflora* Planchon and Linden is a favorite ornamental species.

Family Amaryllidaceae

Genus **Zephyranthes** Herbert

Zephyranthes candida Herbert, Curtis's Bot. Mag., pl. 2607, 1826.

Small, bulbous plant with flat, narrow, grasslike leaves up to 20-30 cm. long. Flowers funnel-shaped, white or slightly rose-tinged on outside, up to 4 or 5 cm. long, solitary on a hollow scape about as long as leaves.

Tongatapu: in roadside ditch near Nuku'alofa, Mar. 7, 1953, *Yuncker 15218.*

[247] [764] [824] An ornamental planted about dwellings and in cemeteries but escaping to roadsides and waste areas. A South American species now widely grown as an ornamental in warm countries.

Tongan name: *feu'u.*

76: Yuncker N-4,5 (1953) 1959 OU9 Tonga OU9

Family CHENOPODIACEAE

The beet (*Beta vulgaris* Linnaeus), chard (*Beta vulgaris* var. *cicla* Linnaeus), and spinach (*Spinacia oleracea* Linnaeus) are occasionally cultivated in plantations as vegetable crops. [137] [244]

Family AMARANTHACEAE

Genus **Amaranthus** Linnaeus

Amaranthus blitum Linnaeus, Sp. Pl., 990, 1753.

Low, spreading, nearly prostrate herb. Leaves small, alternate, obovate, obtuse, base acute, on slender petioles. Flowers very small, in few-flowered, axillary, subsessile clusters.

'Eua: weed beside trail near center of island, Apr. 5, 1953, *Yuncker 15643.* A depauperate specimen but seemingly this species.

Not common in Tonga.

Amaranthus paniculatus Linnaeus, Sp. Pl., ed. 2, 1406, 1763.

More or less pubescent herb. Leaves oblong-ovate to lanceolate. Flowers very small, in numerous, long, slender, ascending, dark red or yellowish spikes arranged in large, showy, paniculate clusters.

Vava'u: *Barclay.*

Widely cultivated as an ornamental. Occasional as a weed. [247]

Amaranthus viridis Linnaeus, Sp. Pl., ed. 2, 1405, 1763.

Coarse, glabrous, erect herb, up to about 1 m. tall. Leaves alternate, ovate to ovate-lanceolate, obtusish, base acute, long-petiolate. Flowers minute, greenish, sessile, in axillary clusters, in long, densely flowered, terminal and axillary spikes; fruit a membranous utricle.

Tongatapu: weed in banana plantation, Nualei, Nov. 1, 1951, *Hürlimann 100;* dooryard weed, Fu'amotu village, Mar. 4, 1953, *Yuncker 15164.*

'Eua: plantation weed on western side of island, Mar. 25, 1953, *Yuncker 15470.*

Tafahi: roadside weed between township of Tafahi and Faihavanui, Dec. 15, 1951, *Hürlimann 541.*

A weed of plantations and waste areas throughout Tonga. Widespread in warm climates.

Tongan names: *longolongo'uha, tupu'a.*

The young leaves are sometimes eaten as a vegetable.

Hemsley lists *Amaranthus caudatus* Linnaeus as collected by Cook on Tongatapu. This is an ornamental species, and there is some question as to whether it was in Tonga at the time of Cook's voyages. [262] [824]

76: Yuncker N-4,5 (1953) 1959 OU9 Tonga OU9

Low, short-stemmed, glabrous herb with creeping, flagelliform branches. Leaves mostly radical, deeply pinnately lobed and divided, terminal leaflet rounded and somewhat larger than lateral ones. Flowers small, white, in long, racemose clusters on mostly leafless peduncles up to 10 cm. or more long; the pods subterete, divergent, about 2.5 cm. long. 137

Tongatapu: in crevices on seaside limestone cliff at Fangaveha, June 7, 1953, *Yuncker 16251.*

'Eua: weed near plantation house, Mar. 22, 1953, *Yuncker 15422.*

Kao: on thin soil near summit, alt. about 990 m., May 6, 1953, *Yuncker 15909,* a form [?] with small, scarcely divided, dentate leaves.

Vava'u: *Barclay.*

A roadside and waste-area weed throughout Tonga. Widespread in the Pacific area.

Cardamine sarmentosa Forst. in Hemsley's list.

Tongan name: *'atono.*

The cauliflower (*Brassica oleracea* Linnaeus var. *botrytis* Linnaeus), cabbage (*B. oleracea* var. *capitata* Linnaeus), kohlrabi (*B. caulorapa* Pasquale), radish (*Raphanus sativus* Linnaeus), and turnip (*Brassica rapa* Linnaeus) are cultivated to some extent as garden vegetables. [244] [824]

Family CRASSULACEAE

Genus **Bryophyllum** Salisbury

Bryophyllum pinnatum (Lamarck) Kurz, Asiatic Soc. Bengal, Jour. 40(2): 52, 1871.

Fleshy, glabrous plant, somewhat woody at the base, the flowering stems up to about 1 m. tall. Leaves very fleshy, opposite, simple or pinnately compound, with three or five oval-oblong, crenately toothed, obtuse leaflets which readily develop young plants from notches when in contact with soil, petioles up to 5 cm. or more long. Flowers about 3-4 cm. long, four-lobed, calyx greenish, thin, inflated, corolla reddish, tubular, in large terminal panicles.

Tongatapu: in sandy waste area near sea east of Nuku'alofa, Feb. 27, 1953, *Yuncker 15173.*

Occasional in sandy or rocky areas near the sea throughout Tonga. A tropical Asian species now of pantropic distribution.

Tongan name: *pipi vao.*

Family PITTOSPORACEAE

Genus **Pittosporum** Banks

Pittosporum arborescens Rich, ex A. Gray, U.S. Expl. Exped., Bot. 1: 223, 1854.

Tree, up to 9 or 10 m. or more tall. Leaves alternate, crowded toward ends of branches, obovate-oblong, oblong, or elliptic, obtuse or subacute, base acute to cuneate, up to 12-14 cm.

76: Yuncker N-4,5 (1953) 1959 OU9 Tonga OU9

Canavalia sericea A. Gray, U.S. Expl. Exped., Bot. 1: 40, 1854. 137

Trailing or climbing, densely silky-pubescent vine. Leaves alternate, trifoliate, leaflets rounded-ovate to subobovate, obtuse or slightly emarginate, base acutish or obtuse, up to 9 cm. long and nearly as wide. Flowers about 3 cm. long, short-pedicellate, in axillary, racemose clusters, corolla rose-colored; pod flattened, up to about 14 cm. long, one edge three-ridged.

Tongatapu: in strand thicket, near Vaini village, Feb. 26, 1953, *Yuncker 15050;* seaward side of strand thicket above Niutoua village, Mar. 2, 1953, *Yuncker 15143;* pioneering on sand, outer edge of seaside vegetation, near Blow Hole area below Houma village. June 1, 1953, *Yuncker 16220.*

'Eua: seaward margin of strand thicket. Apr. 1, 1953, *Yuncker 15597.*

Nomuka: strand thicket above village, Apr. 30, 1953, *Yuncker 15808.*

Lifuka: spreading on sand just above high-tide limit along eastern shore of island, Apr. 27, 1953, *Yuncker 15758.*

Frequent along the outer edge of the strand vegetation throughout Tonga. Polynesia.

Tongan name: *fue tahi veveli.*

Genus **Phaseolus** Linnaeus

Phaseolus adenanthus G. W. F. Meyer, Prim. Fl. Esseq., 239, 1818.

Slender, glabrous, or somewhat pubescent, twining, herbaceous vine. Leaves alternate, trifoliate, leaflets firm, oblong-ovate or ovate, acute, base obtuse or acutish, up to 14 cm. long and 6-7 cm. wide, three-nerved from base, midrib branched upward. Flowers up to 3 cm. long, white tinged with purple, short-pedicellate, in long-pedunculate, axillary, racemose clusters, flowers few and approximated near end of peduncle; pods linear, recurved, flat, up to 10 cm. long and 1 cm. wide.

Tongatapu: *Moseley.*

Vava'u: *Crosby;* climbing in thicket along road west of Leimatua village, northwest of Neiafu, May 19, 1953, *Yuncker 16021.*

Occasional. Pantropic.

Tongan name: *fue 'uta.*

Phaseolus aureus Roxburgh, Hort. Beng., 55, 1814; Fl. India, ed. 2, 3: 297, 1832.

Erect or climbing herb, stems furrowed and brown-pilose. Leaves alternate, trifoliate, leaflets broadly ovate, subrhomboid or suborbicular, rather thin, short-acute, stipules large, ovate. Flowers comparatively small, yellow, in clusters of four to six, at end of stout, villous peduncles; pod nearly cylindrical, up to 6-8 cm. long, somewhat curved, seeds nearly round, small, green or golden.

Vava'u: *Barclay.*

Rather widely cultivated as a vegetable or forage plant.

P. mungo L. in Hemsley's list [?].

Phaseolus semierectus Linnaeus, Mantissa 1: 100, 1767. [244] [246] [824]

Erect, branching, subwoody, pubescent plant, up to 1.5 m. tall, hairs more or less reflexed, branches rather long. Leaves alternate, trifoliate, leaflets narrowly ovate or

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Occasional throughout Tonga. Widely disseminated in warm countries. 137

Tongan name: *pini 'ae puaka.*

The seeds are said to be poisonous unless cooked.

Peanuts (*Arachis hypogaea* L.), garden beans (*Phascolus* spp.), peas (*Pisum sativum* L.), and soybeans [*Glycine max* (L.) Merrill] are cultivated as plantation and garden crops. [244] [824]

Family OXALIDACEAE

Genus **Oxalis** Linnaeus

Oxalis corniculata Linnaeus, Sp. Pl., 435, 1753.

Small, creeping, pubescent herb, stems ascending to 15 cm. or more. Leaves palmately compound, leaflets three, obcordate, about 1 cm. long, ciliate. Flowers yellow, in two- to six-flowered umbels, pedicels slender, 1 cm. or more long, on axillary peduncles; capsule cylindrical, up to 12 mm. or more long.

Tongatapu: *Moseley;* on rocks near sea, near Vaini, Feb. 26, 1953, *Yuncker 15052;* strand terrace near Houma, Oct. 28, 1951, *Hürlimann 15.*

'Eua: along path crossing high plateau of eastern ridge above Fuai, Nov. 9, 1951, *Hürlimann 201;* along open trail in forest near center of the island, Apr. 5, 1953, *Yuncker 15647.*

A common plantation and waste-area weed throughout Tonga. Pantropic.

Tongan name: *kihikihi.* The leaves are used in preparing medicines. [278] [824]

Genus **Averrhoa** Linnaeus

Averrhoa carambola Linnaeus, Sp. Pl., 428, 1753.

Small tree, up to about 6 m. tall. Leaves alternate, odd-pinnate, leaflets elliptic, acuminate, base acute, up to 6 cm. long and 3 cm. wide, petiolules scarcely 5 mm. long. Flowers red and white, small, in small, axillary clusters; fruit greenish yellow, waxy, up to 10 cm. or more long, strongly five-angled, fleshy, edible.

Tongatapu: in garden in Nuku'alofa, Mar. 7, 1953, *Yuncker 15220.*

Of recent introduction. A tropical American plant now widely cultivated for its fruit. [244] [824]

Family RUTACEAE

Genus **Fagara** Linnaeus

Fagara pinnata (J. R. and G. Forster) Engler, in Nat. Pflanzenfam. 3(4): 119, 1896.

Tree up to 12 m. tall. Leaves alternate, even-pinnate, leaflets two to five pairs, entire, somewhat obliquely elliptic, acuminate, base shorter on one side, acute, up to 7-8 cm. long and 3 cm. wide, pinnately nerved, midrib nearer shorter side. Flowers in axillary, branching clusters up to 15 cm. long; fruit about 1 cm. long, dehiscent, one-seeded, seed black.

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Cultivated throughout the group for its edible roots.[1] A tropical American species now of pantropic cultivation.

Tongan name: *manioke*. The following varieties are recognized:

Manioke falaoa: stem is pale green, the tuber white.

Manioke hina: stem and leaves are pale green; the skin of the tuber is brown without, pink within.

Manioke koka'anga: stem is dark red, the leaves dark violet, the skin of the tuber is red; the tuber is bitter unless properly prepared and is used to prepare an adhesive paste.

Manioke leka hina: stem and leaves are pale green, the tuber white.

Manioke leka kula: stem is light brown, the petiole red, and the skin of the tuber dark red.

Genus **Codiaeum** Jussieu

Codiaeum variegatum (Linnaeus) Blume, Bijdr. Fl. Java, 606, 1825.

Densely branched, glabrous shrub. Leaves alternate, varying greatly in shape and size, commonly entire, sometimes interrupted or twisted, pinnately nerved, mostly acuminate, variegated green, red, pink, yellow, and white. Flowers small, monoecious, in axillary, racemose clusters.

'Eua: *Lister.*

Tafahi: in cemetery beneath the township of Tafahi, alt. 30 m., Dec. 17, 1951, *Hürlimann 594.*

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Cultivated as an ornamental throughout Tonga. Pantropic.

Genus **Croton** Linnaeus

Croton storckii Seemann, Bonplandia 10: 297, 1862.

Shrub with sparse, stellate pubescence glabrescent. Leaves alternate, ovate, short-acuminate, base rounded, bi-glandular, up to 10 cm. long and 5 cm. wide, the petiole up to 2.5 cm. long. Flowers small, in terminal, racemose clusters up to 5 cm. long.

Vava'u: *Crosby 150.*

Also in Fiji.

C. microtiglium Burkill (Linn. Soc. Bot., Jour. 35: 54, 1901). See also the note by A. C. Smith (B. P. Bishop Mus., Bull. 141: 83, 1936).

Genus **Excoecaria** Linnaeus

Excoecaria agallocha Linnaeus, Syst., ed. 10, 1288, 1759.

Tree up to 10 or 12 m. tall, the latex white, adhesive, irritating. Leaves alternate, glabrous, oval or oval-obovate, acutish or rounded and retuse, base obtuse to acutish, bi-glandular, up to 8 cm. or more long and 6-7 cm. wide, pinnately nerved, lateral nerves slender and inconspicuous, petiole up to 2 cm. long. Flowers monoecious, small, male flowers in many-flowered, axillary spikes up to 5 cm. or more long, female flowers in axillary racemes up to 3 or 4 cm. long; capsules subglobose, about 5 mm. in diameter.

Tongatapu: *Cook; Home;* in thicket, Sopu, Feb. 25, 1953, *Yuncker 15025;* in swampy area near Navutoka village, Feb. 27, 1953, *Yuncker 15072;* near Fatai toward sea, Oct. 30, 1951, *Hürlimann 62.*

1 /Manihot esculenta -- Analyst/

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'Eua: *Lister;* deep ravine northeast of Ohonua village. Apr. 2, 1953, *Yuncker 15629.* 137

Lifuka: near sea north of Pangai village, Apr. 25, 1953, *Yuncker 15746.*

Vava'u: *Crosby.*

Tafahi: coastal forest, near Hou, alt. 5 m., Dec. 17, 1951, *Hürlimann 586.*

Frequent near the shore throughout Tonga. Pantropic.

Tongan name: *milo.*

The leaves and fruit are used in preparing medicines. The timber takes a good polish, is durable under water, and is used in construction and handicraft work. [824] [278] [313]

Genus **Gossypium** Linnaeus

Gossypium brasiliense Macfayden, Fl. Jamaica 1:72, 1837.

Semi-shrubby, branching plant, up to 1.5 m. or more tall. Leaves alternate, round-ovate in outline, three- to five-lobed, lobes entire, on long petioles. Involucral bracts cordate, laciniate, acuminate, seeds numerous, covered with long, white fibers.

Vava'u: *Crosby.*

Introduced and occasional in villages. Pantropic.

Tongan name: *tavae.*

Hibiscus manihot Linnaeus, called *pelc* by the Tongans, is cultivated for its young growth, which is used as a green vegetable. [824] [244] [262]

FAMILY BOMBACACEAE

Genus **Ceiba** Medikus

Ceiba pentandra (Linnaeus) Gaertner, Fruct. et Semin. Pl. 2:244, pl. 133, fig. 1, 1791.

Medium to large, glabrous, soft-wooded tree with smooth or short-spiny bark and whorled, spreading branches. Leaves palmately compound, leaflets five to nine, elliptic to oblanceolate, entire, of various sizes, acuminate, petioles long. Flowers white or pinkish, petals pubescent, up to 2.5 cm. long; capsules up to 15 cm. long, seeds numerous, silky-hairy.

Introduced and now occasional in villages and along roadsides throughout the group.

The silky seed fibers are used as a filling for pillows and cushions. Probably of tropical American origin; now pantropic. [824]

Tongan name: *tavae.*

FAMILY STERCULIACEAE

Genus **Melochia** Linnaeus

Melochia aristata A. Gray, U.S. Expl. Exped., Bot. 1:193, 1854.

Small tree, up to 4 m. or more tall. Leaves alternate, ovate, acute, base rounded, obtuse or abruptly acute, up to 12 cm. or more long and 8 cm. wide, palmately five- to seven-nerved, midrib branched upward, crenately toothed, petiole slender, up to 8 cm. or more

1 /Thespesia populnea -- Analyst/

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Of this family carrots (*Daucus carota* L. var. *sativa* DC.), parsnips (*Pastinaca sativa* L.), and celery (*Apium graveolens* L. var. *dulce* DC.) are cultivated to some extent as food crops.[1]

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FAMILY MYRSINACEAE

Genus **Maesa** Forskål

Maesa tongensis Mez, in Engler, Pflanzenr. 9 (IV. 236) : 43, 1902.

Shrub or small tree, branches sometimes somewhat scandent, up to 3 m. or more tall. Leaves alternate, elliptic-obovate, apex rounded, base obtuse to acute, up to 12 cm. long and 8 cm. wide, margin entire or uneven, pinnately nerved, nerves, petioles and twigs reddish, petiole up to 2-3 cm. long. Flowers small, in axillary, racemose or paniculate clusters; fruit subglobose, pointed, about 3 mm. in diameter, white.

Tongatapu: climbing in thicket near sea below Fu'amotu village, June 5, 1953, *Yuncker 16244;* roadside, Vahe, *Setchell and Parks 15434.*

'Eua: on seaward terrace of coastal cliff, in thicket along trail down to Lokupo, Mar. 27, 1953, *Yuncker 15527;* on seaward-facing limestone cliff, summit of the eastern ridge, Apr. 8, 1953, *Yuncker 15686.*

Occasional.

Tongan name: *puataukanave.*

M. nemoralis A. DC. and *M. viticnsis* Seem. were included in Hemsley's list, and the former also in Burkill's list. *M. nemoralis* was described from a New Hebrides collection, and there is some doubt as to its occurrence in Tonga. *M. vitiensis* is referred by Mez to synonymy under *M. persicifolia,* a common and presumably Fijian endemic. It appears rather doubtful, therefore, that it occurs in Tonga.

Maesa sp. [?]

Scandent shrublike plant, climbing in thicket. Leaves oval-ovate, acuminate, base obtuse, up to 12 cm. long and 8 cm. wide, thin, entire, pinnately nerved, nerves reddish, petioles about 1 cm. long, slender. Flowers and fruit lacking.

'Eua: in shrubbery thicket in opening in forest near "Smoky Hole" above Fuai plantation, Mar. 31, 1953, *Yuncker 15572.*

Tongan name: *tuamea.*

Genus **Discocalyx** Mez

Discocalyx listeri (Stapf) Mez and Stapf, Pflanzenr. 9 [IV. 236] : 212, 1902.

Glabrous shrub up to 2 m. tall. Leaves alternate, oblong or oblanceolate, up to 15 cm. long and 4-5 cm. wide, obtuse, base narrowed, pinnately nerved, petiole up to 2 cm. long. Flowers small, in terminal panicles.

'Eua: *Lister.*

Presumably endemic to 'Eua. Only the type is cited by Mez.

Ardisia listeri Stapf in Hemsley's list.

[1] /Apium leptophyllum -- Analyst/

76: Yuncker N-4,5 (1953) 1959 OU9 Tonga OU9

Flowers one to three on a long, axillary peduncle, calyx lobes with an awl-like tip up to 1 cm. or more long, corolla tubular with broadly spreading limb, up to 10 cm. or more long, white. 137

Tongatapu: in roadside thicket near Nuku'alofa, 1926, *Setchell and Parks 15610.*

Vava'u: climbing in thicket near shore of lagoon at Vaihoi, May 26, 1953, *Yuncker 16193.*

Infrequent. A tropical American species now widely distributed in warm countries.

I. bona-nox L. in Hemsley's and Burkill's lists.

Ipomoea batatas (Linnaeus) Poiret, in Lamarck, Encycl. Méth. 6: 14, 1804.

Smooth, creeping, herbaceous vine, forming large, edible, root tubers. Leaves alternate, deltoid-ovate, variously lobed but commonly with two prominent basal lobes, acute, petiole slender and longer than blade. Flowers purplish red.

The tubers represent an important item in the diet of the Tongans and are cultivated throughout Tonga. A South American species now pantropic in distribution. 824 262 244

Tongan name: *kumala*. The following varieties are distinguished:

Fa'afonua: stem and leaves are pubescent; flesh of tuber, firm and pink.
Finau: leaves are large, light green; tuber often nodose, white.
Kumala 'ena: leaves are large; tuber, white but purplish toward center.
Kumala kula: stem is greenish red; skin of tuber, red.
Kumala lesi: stem is greenish red; skin of tuber, red.
Kumala vai: stem is green; skin of tuber, pink.
Lokoloka: leaves are large, thin, round; skin of tuber, pale, flesh purplish.
Mosese hina: stem is light green; leaves, large; skin of tuber, pale.
Mosese kula: leaves are large, round, purplish; skin of tuber, pale.
Palatea.
Silika: stem is dark green; skin of tuber, pink.
Tai: skin of tuber, pale.
Teiko: young leaves are purplish; skin of tuber, yellowish.
Tongamai: stem is light green; skin of tuber, pale.

Ipomoea cairica (Linnaeus) Sweet, Hort. Brit., 287, 1827.

Glabrous, slender, twining, branched vine. Leaves broadly ovate in outline, 6 cm. or more long and about as wide, five- to seven-divided, divisions elliptic-lanceolate, acuminate, petioles slender, as long as blade. Flowers narrowly campanulate, 5-6 cm. long, corolla deep lavender, paler outside. 137

Tongatapu: climbing over shrubbery in low, waste area near Nuku'alofa, Mar. 7, 1953, *Yuncker 15201.*

Vava'u: in roadside thicket between villages of Faletoa and Leimatua, Mar. 20, 1953, *Yuncker 16054.*

Occasional as an escape from cultivation. A tropical Asiatic species now widely distributed.

Tongan name: *maile miniti.*

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Tongatapu: near dwelling in Nualei village, Mar. 9, 1953, *Yuncker 15235.* 137

Occasional about dwellings and in plantations. A tropical American plant, now widely planted for its use as tobacco.

Tongan name: *tapaka.*

The tomato (*Lycopersicon esculentum* Miller), the potato (*Solanum tuberosum* Linnaeus), and the eggplant (*S. melongena* Linnaeus var. *esculentum* Nees) are cultivated to some extent as food crops. Many varieties of petunia (*Petunia hybrida* Vilmorin) are grown for ornament. [824] [244] [262] [247]

Family SCROPHULARIACEAE

Genus **Lindernia** Allioni

Lindernia crustacea (Linnaeus) F. Mueller, Census, 97, 1882.

Small, much-branched herb, 10-20 cm. tall, stems angled and slightly winged along ridges. Leaves opposite, ovate, acute at both ends, serrate, up to about 1 cm. long, sparsely pubescent, petiole very short. Flowers 5-8 mm. long, pale lavender, solitary on rather long, slender, axillary pedicels; capsule obovate-elliptical, compressed, about 3 mm. wide.

Kao: on thin rocky soil in open alpine area, alt. 600-700 m., May 6, 1953, *Yuncker 15925, 15930.*

Vava'u: *Crosby.*

Infrequent. A native of the Old World tropics; now of wide distribution in warm climates of both hemispheres.

Genus **Russelia** Jacquin

Russelia equisetiformis Schlechtendal and Chamisso, Linnaea 6: 377, 1831.

Semi-shrubby plant, up to about 1 m. tall, with longitudinally ridged, green stems, and numerous verticillately arranged, drooping branches. Leaves very small, linear or awl-shaped, whorled. Flowers about 2.5 cm. long, in lax, terminal clusters, corolla tubular, red.

Occasional in villages. A Mexican species, now widely cultivated in warm countries as an ornamental.

Family BIGNONIACEAE

Genus **Stenolobium** D. Don

Stenolobium stans (Linnaeus) D. Don, Edinb. Philos. Jour. 9: 88, 1823.

Large shrub, about 4 m. tall. Leaves opposite, pinnate, leaflets five to 13, narrowly elliptic, up to 10 cm. or more long and 3 cm. wide, serrate, acuminate, base cuneate, sessile, pinnately nerved. Flowers in large, terminal, paniculate clusters, corolla up to 5 cm. long, yellow, narrowly bell-shaped, ornamental; fruit narrow, up to about 10 cm. long.

Tongatapu: near dwelling in Nuku'alofa, Mar. 7, 1953, *Yuncker 15200.*

An American species, now widely planted as an ornamental in warm countries.

1 /Nicotiana tabacum -- Analyst/

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Genus **Benincasa** Savi

Benincasa hispida (Thunberg) Cogniaux, DC. Monogr. Phanerog. 3: 513, 1881. 137

Wide-spreading, hairy vine. Leaves rounded-ovate, base rounded, cordate, 5- or 7-lobed, up to 25 cm. or more wide, tendrils branched. Flowers yellow, 8-10 cm. or more wide, solitary, axillary, male flowers long-pedicellate; fruit oblong to cylindrical, up to 40 cm. long, hairy, flesh white, edible.

Vava'u: *Crosby.*

An Asiatic species now widely cultivated as a food plant.

The muskmelon (*Cucumis melo* Linnaeus), the cucumber (*C. sativus* Linnaeus), the watermelon (*Citrullus vulgaris* Schrader), the squash (*Cucurbita maxima* Duchesne), and pumpkins (*C. pepo* Linnaeus) are cultivated for their fruit. [824] [244] [262]

FAMILY CAMPANULACEAE

Genus **Wahlenbergia** Schrader

Wahlenbergia marginata (Thunberg) A. de Candolle, Monogr. Campanul., 143, 1830.

Low, nearly glabrous herb with strong tap root, stem with numerous, slender, erect branches. Leaves small, alternate, linear-lanceolate, reduced, scalelike upward. Flowers blue, on very slender pedicels up to 3 or 4 cm. long, in few-flowered, branching, terminal clusters.

'Eua: in moist, grassy area on central plain approaching eastern ridge, Mar. 30, 1953, *Yuncker 15551.*

An Asiatic species rare in Polynesia.

Probably the same species collected on 'Eua by Lister and reported by Hemsley as *W. gracilis* A.DC.

Genus **Hippobroma** G. Don

Hippobroma longiflora (Linnaeus) G. Don, Gen. Syst. 3: 717, 1834.

Thinly pubescent, sparsely branched herb up to 25 or sometimes 50 cm. in height. Leaves alternate, elliptic-lanceolate, acute, narrowed to sessile base, margin sharp-toothed, up to 10 or 15 cm. long, pinnately nerved. Flowers white, axillary, tubular, narrow tube up to 6 or 8 cm. long, lobes spreading to 3 or 4 cm.; capsule nodding, about 1.5 cm. long.

Tongatapu: local in low, moist situations about Nuku'alofa, Mar. 7, 1953, *Yuncker 15197.*

A native of tropical America widely distributed in the tropics where it often escapes from cultivation. The juice is said to cause skin irritation and the plant to be poisonous when eaten. In the most recent treatment of this group, Wimmer [Pflanzenr. 107 (IV. 276b): 405, 1953] discusses the species as *Laurentia longiflora* (L.) Endl.

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Takafia. To operate, as medicine in the system.
Tale. A cough; to cough.
Tamaki. Sore eyes.
Tamala (Tamalamala). Bitter in taste.
Tamate. To kill; to dry; healing; dying away. (Applied to wounds.)
Tamatemata. Dry; healing (applied to wounds).
Tamato. A miscarriage; an abortion.
Tane. A skin disease.
Taubiko. Humpbacked.
Tauhi. A nurse.
Teba. Cross-eyed.
Tega. A swelling; a tumor; the thigh.
Tetea. Pale; pallid; white.
Toba. A sore mouth.
Toi. A drop; to drop.
Tokakovi. Qualmish; feeling sick.
Tokalosi. A surgical operation.
Tolele. Purged; the act of being purged.
Tologulu. To rattle in the throat; a rattling in the throat.
Tolounua. A sore caused by a splinter.
Tona. A native disease resembling smallpox.
Toto. Blood; to bleed.
Totofo. To seek medicine.
Tuaki. Breeding sickness.
Tuia. Attack or seizure by disease; to be pierced or wounded by anything sharp.
Tuituia. Conception; to conceive.
Tukifulei. Onanism.
Tuli. Deaf; deafness.
Tuloia. A sore.
Tului. To drop in the eye, or into a wound.
Tuluta. A single drop.
Tutue. Lean; meagre; leanness; emaciation.
Tuu. A white, mattery substance in the eye; one kind of *kabe* (abuse).
Tuujiuho. To cut the umbilical cord.
Tuumoa. To relieve nature.

Ufitea. A film.
Unani (Unounani). To eat sparingly or delicately.

Vai. Water; medicine; a liquid.
Vaivai. Weak; frail; faint; feeble; helpless.
Veefua. Elephantiasis.
Vela. Hot; a burn; a scald; to burn; to scald.
Veli (Velia). To itch.

NAMES OF YAMS GROWN IN TONGA

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Akutava
Akutava hina (white Akutava)
Akutava kula (red Akutava)
Akutava maka (stone Akutava)
Bua
Bua kula (red bua)
Bua hina (white bua)
Bunailave
Fuhi fuhi
Fala fala
Faaofonua
Faka Talakona
Gu vai (water gu)
Gu fietua
Gu kafakafa
Gu hina (white gu)
Gu pakata
Gu kula (red gu)
Gu palatea (gu white rot)
Gu kiaimoa
Gu laba
Heketala
Heketala vai (water heketala)
Heketala hina (white heketala)
Heketala bakaka
Heketala balaa
Heketala kula (red heketala)
Hoi kai
Kafiu
Kahokaho tefau
Kaho kaho Siamane (Germany)
Kaho kaho
Kaho hako vai (water kaho kaho)
Kaho kaho ulumaka (stone hedges kaho kaho)
Kapakauikava
Kaumeile bekavalu
Kaumeile talo (Kaumeile taho)

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Kaumeile uli (black kaumeile)
Kau meile
Kau meile ata
Kau meile hina (white kau meile)
Kau meile kula (red kau meile)
Kau meile kulu
Kau meile uli (black kau meile)
Kivi
Kivi hina (white kivi)
Kivi kula (red kivi)
Kivi hako
Kou kau (wild yam of Vavau)
Kulo
Kulo hako
Kulo hina (white kulo)
Kulo kau
Kulo kula (red kulo)
Lausi
Lavau
Lavau hina (white lavau)
Lavau kula (red lavau)
Lavelio
Lau boa
Lau mahi
Lebaleba
Levei
Lokaloka futuna (yam from Futuna Island)
Loko loka
Loko loka hina (white loko loka)
Loko loka kula (red loko loka)
Mahoaa
Mahoaa leleva
Malai
Malau
Malekini
Mamage
Mamage fau (bearing mamage)
Mamage hina (white mamage)
Mamage kula (red mamage)
Mavage kula (red mavage)
Moala
Moala hina (white moala)
Moala kula (red moala)
Nise
Niua
Palatea
Palai
Solomone (Solomon)
Sivoli
Takulevu
Takulevu huku (short takulevu)
Takulevu hina (white takulevu)
Takulevu kula (red takulevu)
Talakona
Tamuni
Tamuni keu
Tapuane
Tefau
Tua
Tua ata
Tua fietua
Tua hina (white tua)
Tua kula (red tua)
Tua ulumaka (stone-headed tua)
Tua vai (water tua)
Ufi Fiji (Fiji yam)
Ufi Fiji Bunuluo
Ufi Fiji hina (white Fiji yam)
Ufi Fijj kula (red Fiji yam)
Ufi Fiji lagakali
Ufilei maka (stone ufi lei)
Ufilei mamage
Ufi lei
Ufi lei hina (white ufi lei)
Ufi lei kula (red ufi lei)
Ufi lei kauhola
Ufi lei lavilavi
Ufi liliu
Ufi Uvea (Uvea yam)
Vesi vesi
Voli
Voli hina (white Voli)
Voli kula (red Voli)
Voli leka (Dwarf Voli)

128 The individual species are discussed in this section.

241 A great diversity of introduced species are commonly
137 found in cropping sequences and secondary vegetation associations on the island. The groups of plants that will
128 be discussed include: important staple and commercial crops; supplementary food plants; important non-food plants; important tree species; and common weed and secondary vegetation species. A comprehensive listing of these plant species and their uses is found in Appendix E. A

241 Important Staple and Commercial Crops

Staple food plants and commercial crops are the most important crops on bush allotments in terms of total acreage and include the following species:

244 [439] The greater yam - 'ufi (Dioscorea alata). The greater yam is traditionally the most prestigious of Tongan subsistence crops as well as being a minor export crop. Its center of origin is believed to be tropical Southeast Asia (Herklots, 1972: 418). It is known only in cultivation and was introduced prior to European contact. Numerous kinds of yams are recognized by Tongans; Whitecomb (1930: 19-20) listed 114 different kinds. The major kinds now cultivated are the kahokaho (which is considered the best and most prestigious), kaumeile, maho'a'a, kulo, kivi, takulevu, voli, and tamuni. Yams are generally planted from May through December, take six months to one year to mature depending on the variety or desired size, and are

A [See Category 137, pp. 377-431--Analyst.]

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harvested from December through June. Planting material consists of either cut up pieces of tubers or small tubers (fua'i'ufi) which grow alongside the main tuber. These are planted in deep, well-prepared holes filled with friable soil.

The Goa, lesser or sweet yam - ufilei (Dioscorea esculenta). The Goa yam is a traditional staple crop of major importance in the Niuas (Niuatoputapu, Niuafo'ou and Tafahi), but is of limited importance on Tongatapu. It is probably native to Indo-China (Herklots, 1972: 424) and was present in Tonga prior to European contact. Numerous varieties are recognized by the people of the Niuas, but most people on Tongatapu refer to them simply as 'ufilei. Like the great yams, it is planted from May through December, takes six months to one year to mature, and is harvested from December through June. Planting material consists of small tubers, or tops, or sections of tubers.

Giant taro - kape (Alocasia macrorrhiza). The giant taro is another prestigious traditional crop found on a majority of bush allotments. Its place of origin is believed to be India and Sri Lanka (Herklots, 1972: 403) and it was a pre-European introduction into Tonga. A number of kinds are recognized by Tongans, eight kinds being listed by Churchward (1959: 252). The most common varieties on Tongatapu are kape hina and kape fuohenga.
Giant taro is generally planted from July through September

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or October, takes approximately 14 months to mature, and is harvested from August or September through November or December. Planting material consists of young shoots or cuttings from the edible stem; these are planted in holes and covered with soil.

Taro or swamp taro - talo Tonga (Colocasia esculenta). The swamp taro, a traditional staple crop which was formerly more extensively cultivated, is being replaced to a great extent by American or dryland taro varieties introduced after European contact. It is, however, still a more prestigious and preferred crop than the dryland varieties and is exported in limited qualities. It probably originated in North India (Herklots, 1972: 404) and was a pre-European contact introduction into Tonga. A number of varieties of swamp taro are recognized by Tongans although most are generally referred to as talo Tonga (Tongan taro). Swamp taro can be planted throughout the year; the optimum time, however, is during the rainy season from December through March. It takes from 9 to 18 months to mature and can be harvested at any time during the year. Planting material consists of the leaf-bearing section from the top of the tuber, which is placed in holes and covered with soil.

[439]

American taro, dryland taro, tannia, yautia or coco yam-talo Futuna or talo kula (Xanthosoma violaceum). This aroid of tropical American origin, was probably introduced

244 into Tonga during the ninteeenth century, possibly via Hawaii (Barrau, 1961: 40). It has become one of Tonga's most important staple crops and is found on most bush allotments and many town allotments. It can be planted throughout the year, although most planting occurs between June and September. The tubers take about one year to mature and, because they store well in the ground for two years or more, can be harvested at any time. Consequently, it is occasionally an important species in fallow vegetation associations. Planting material consists of cuttings from the tubers, which are placed in holes and buried. Another very similar American species, Xanthosoma sagittifolium, known as talo tea, is an important staple, although not as widely cultivated on Tongatapu as X. violaceum. To obtain the most palatable tubers it must be harvested after approximately one year.

Sweet potato - kumala (Ipomoea batatas). The sweet potato, although native to tropical America, was almost certainly present in Tonga prior to European contact (Herklots, 1972: 436). The original varieties, however, have almost entirely disappeared in favor of more palatable varieties introduced by Europeans (Barrau, 1961: 54). The sweet potato is of increasing importance as a major staple crop and is found on many bush allotments. There are over ten different kinds recognized by Tongans, the most common being the siale, tongamai, and palu or mahina tolu (three

244 month) varieties. In the past, most sweet potatoes were planted from February through October, although year round planting is now common. Depending on the variety, sweet potatoes take three months to one year to mature and can be harvested throughout the year, although they are most abundant from December through February. Planting material consists of cuttings from the leaves and stems, which are planted in the loosened earth mounds.

Manioc, cassava or tapioca - manioke (Manihot esculenta). Manioc, which is native to South America, possibly Brazil (Herklots, 1972: 446), was probably introduced into Tonga early in the nineteenth century shortly after the beginning of European settlement (Barrau, 1961: 53). Because it requires almost no care or weeding, produces high yields, and can grow in the poorest of soils, it has become the widely planted staple crop on Tongatapu. [287] A number of different varieties are recognized, although most Tongans make little distinction except between edible varieties and those used in the preparation of paste for the tapa making process. Manioc is planted year round, takes from 5 to 12 months to mature, is harvested throughout the year, and will remain edible for long periods of time in the ground, providing an emergency food source in times of shortage. Planting material consists of cuttings of the stalks, which are simply pushed into loosened earth.

245 Breadfruit - mei (Artocarpus altilis). The breadfruit

245 is found on almost all bush allotments, planted either in systematic rows or in a random fashion, in varying numbers on most town allotments, as well as growing naturally along the coast. Numerous kinds of coconuts are known to Tongans, the most common varieties being niu kafa, niu mea, niu matakula, niu ui, niu'utongau, niu mea'alava, niu leka 245 and niu ta'okave. Very little scientific selection of high 242 yielding varieties is practiced, the planting material in most cases consisting of suitable fallen nuts. With the establishment of the Coconut Replanting Scheme, however, new varieties from Sri Lanka were introduced and nurseries were established to improve selection of local planting 245 material. Coconut palms are planted throughout the year, take from seven to ten years to come into bearing, and bear fruit through out the year.

244 Watermelon - meleni (Citrullus vulgaris). The watermelon, which is native to the Kalahari Desert of Southwest Africa (Herklots, 1972: 314), was possibly first introduced into Tonga by Captain Cook on his second voyage [438] (Beaglehole, 1969: 262). It is Tonga's third most important [439] export crop, is a major item at the local market, and is grown on bush allotments throughout Tongatapu on a commercial basis. There are two kinds of watermelon commonly grown, the "Ice Cream" and "Market Wonder," both [439] of which are referred to as meleni by Tongans. Although the "Ice Cream" is sweeter, the "Market Wonder" ships

244 [439] better and is favored for export (Johansson, c. 1956: 3). Although melons are planted throughout the year, the best planting time is from May to August during the drier part of the year. At this time, there is a lower incidence of fungal diseases and other pests and the melons tend to be sweeter. Watermelons take about three to four months to mature with the largest harvests occurring from August [438] through December. Planting material consists of seeds purchased either through stores in Nuku'alofa or from the Produce Board.

245 Pineapple - faina (Ananas comosus). The pineapple is of tropical American origin (Prevost and Pitkanen, 1970:58), and was an early European introduction, probably by Cook on [438] his second voyage in 1773 (Beaglehole, 1969: 262). It is [439] grown in large patches throughout Tongatapu for export and local sale, as well as being intercropped with other crops on both bush and town allotments. The two most common varieties are the "Rough" and the "Ripley Queen", known locally as fainŋ Tonga (Tongan pineapple) and the piu respectively. The Ripley Queen is favored for export owing [439] to its larger size (Johansson, c. 1956: 3). The optimum planting season for pineapple seems to be from September through December; the plants begin to bear in about 14 months and are most abundant from September through January. [242] Some farmers have been producing crops throughout the year by treating the plants with a hormone. Planting material

245 consists of suckers from mature plants or the leaf-bearing portion of the fruit.

244 Peanuts or groundnuts - pinati (Arachis hypogaea). The peanut, which is thought to be native to South America (Baker, 1970: 56), is a post-European introduction (Massal and Barrau, 1956: 30). It has been grown in Tonga for a number of years and, although a concerted attempt was made after World War II and in the early 1960's to establish it as an important export crop, it is now grown primarily for local sale by street vendors in Nuku'alofa. There are two main varieties recognized by Tongans, the foua or two-seeded variety and fo tolu or three-seeded variety. Although no reliable data on planting and harvesting dates could be obtained, it seems that there are two different planting times for peanuts, September and January; the plants take three to four months to bear depending on the variety and are reportedly harvested in January and May.

Tomato - tomata (Lycopersicon esculentum). The tomato, native to western Peru and Ecuador, is a comparatively recent European introduction (Herklots, 1972: 360-161). In 1971, it was Tonga's number four export crop after coconuts (and coconut products), bananas, and watermelons respectively. It is becoming an increasingly common addition to the cropping complexes on bush allotments throughout Tongatapu. It is also a major item at the market in Nuku'alofa and is often grown for home use, along with

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[438] other garden vegetables, in small plots on both bush and town allotments. Medium sized red tomatoes are most common, although the smaller cherry tomato is also found, often growing wild in ruderal places. Tomatoes and most other garden vegetables are planted beginning in April or May (following the hot, rainy season) and are harvested starting in May through November or December. Some farmers, however, have been able to grow them for local sale on a year-
[438] round basis. Seeds are generally purchased from the large trading stores in Nuku'alofa or from the Produce Board.

Bell pepper or capsicum - polo or polo palangi (Capsicum annuum). Bell pepper is a post - European introduction from tropical America (Herklots, 1972: 350).
[439] Like the tomato, it is rapidly becoming an important
[438] commercial crop for export and for local sale and an increasingly common addition to the crops grown on bush allotments. Planting and harvesting times, acquisition of planting material, etc. are the same as for the tomato.

Other introduced Vegetables. There are a number of
[439] other vegetables, most of comparatively recent introduction,
[438] which, although of minor importance, have been exported from time to time to New Zealand, Fiji, or Samoa and are currently sold locally at Talamahu Market. These vegetables include: green beans - pini (Phaseolus vulgaris), native to Central America; European cabbage - kapisi (Brassica oleracea var. capitata), carrots - kaloti (Daucus carota)

244 and beets - pitiluti (Beta vulgaris), all native to Europe or the Mediterranean; lettuce - letisi (Lactuca sativa) and bulb onions - onioni Palangi (Allium cepa), both native to the Middle East; cucumbers - kiukamipa (Cucumis sativus) and eggplant - paigani (Solanum melongena), both native to India; Chinese cabbage - kapisi Siaina (Brassica chinensis and B. pekingensis), native to China; and radishes - latisi (Raphanus sativus), native to Europe and Asia (Berklots, 1972). Most of these are grown infrequently, and are generally in season at the same time as [438] tomatoes and bell peppers. The seeds are purchased primarily from large trading stores.

245 Vanilla - vanila (Vanilla planifolia). Native to [439] Mexico (Macmillan, 1956: 330), vanilla has been successfully introduced into Vava'u where it has now become an important export crop. Within the past few years, a small number of Tongatapu farmers have also planted vanilla on their bush and town allotments. It is generally planted using the physic nut or fiki (Jatropha curcas) to climb on. As of yet, it is of little or no economic importance on Tongatapu.

241 Supplementary Food Plants

In addition to staple food plants and commercial crops, there are a considerable number of supplementary, non-arborescent food plants commonly grown on bush and town 000 allotments throughout Tongatapu. These crops include:

000 and lesi 'Initia.

249 Sugar cane - to (Saccharum officinarum). The sugar cane, believed to be of New Guinea origin, was present in [439] Tonga before European contact (Barrau 1971: 18). It is exported in small quantities, but is primarily a traditional subsistence crop grown on both bush and town allotments. The most common varieties recognized locally are au, to hina, to kula, and heleveka.

Kava (Piper methysticum). Kava, a traditional pre-European plant, is probably a native of the western Pacific. The roots and branches are made into the traditional Tongan social beverage of the same name. The plants, which take more than two years to mature and improve with age, are found on many bush and town allotments.

244 Green onion or shallot - onioni Tonga (Allium ascalonicum). The green onion is native to the Northern Hemisphere, possibly Eurasia (Herklots, 1972: 387), and is [438] probably a post-European contact introduction. It is common at the local market and is grown on many bush and town allotments throughout Tongatapu, either alone in vegetable gardens or intercropped with other subsistence plants.

Pumpkin - hina (Cucurbita pepo) - The pumpkin, of American origin, was reputedly introduced by Captain Cook. It is grown on many allotments, generally intercropped with other crops as well as growing wild in a somewhat

naturalized state.

Passionfruit - vaine or vaine Tonga (Passiflora edulis). Passionfruit, a native of tropical South America and of post-European contact introduction (Merrill, 1945: 152), is commonly grown on town allotments on trellises or trees as well as growing in a naturalized state in the bush. It is occasionally sold at the market in Nuku'alofa.

Granadilla - pasione. (Passiflora quadrangularis). The granadilla, also of tropical American origin and post-European contact introduction, is commonly found growing on trellises on town allotments, and occasionally on bush allotments.

Ladyfinger-misapeka (Musa clens). This dwarf banana, which was introduced into Tonga by Shirley Baker in the 1870's (Rutherford, 1971: 54), is infrequently cultivated on Tongatapu and is eaten in a ripened state as a fruit.

Cordyline - si (Cordyline terminalis). Si, native to the Southeast Asian - Pacific region and present before European contact (Barrau, 1971: 21), is found both as an ornamental and as a cultivated or naturalized edible variety (sometimes referred to as si kai), which, although very common, is eaten only sparingly or in times of food shortage. It is found on most bush and town allotments, in many cases overrun by bush.

Cherry tomato - temata vao (Lycopersicon esculentum var. cerasiforme). This variety of the common tomato,

244 [262] native to South America and a post-European contact introduction, is generally not purposefully planted, but is found on many bush and town allotments and is eaten occasionally.

Chile pepper or tabasco - polo fifisi (Capsicum frutescens). The chile pepper is native to tropical America and of post-European introduction (Herklots, 1972: 351). Like the wild tomato, it is generally found in a feral state growing amongst secondary vegetation throughout Tongatapu or occasionally in a cultivated state on both bush and town allotments.

245 Coffee - kofi (Coffea arabica). Coffee, a native of the Ethiopian Highlands, was probably not introduced until the latter half of the Nineteenth century (Baker, 1970: 110-112; Parham, 1972: 267). It is occasionally grown in small concentrations in isolated forest stands or under trees on bush or town allotments. Although some local coffee is prepared by a number of families, it is not produced on a commercial basis.

249 272 Lemon grass - moengālō (Cymbopogon citratus). Probably a native of Malaysia (Herklots, 1972: 483) and probably introduced around the turn of the century (Parham, 1955: 122), lemon grass is frequently planted on both bush and town allotments, the leaves being used in the preparation of tea and the roots for scenting coconut oil.

subsidies for adequate maintenance of the young trees, and many new palms have been killed as a result of burning, competition by weeds, or trampling by horses or cattle. The fertilizer is often diverted to other crops, such as watermelons or European vegetables. The palms generally are poorly cared for and many allotments are not planted with sufficient palms to obtain maximum yields. Nevertheless, the fact that most allotments do have mature coconut palms, and some have replanted palms, reflects their importance not only as a source of cash but also as a major staple item in the Tongan diet.

Bananas and Other Commercial Agricultural Exports

The other export crop, bananas, along with commercial watermelons, pineapples, and garden vegetables, have also become integral parts of the cropping sequences on bush allotments. In 1940, bananas, watermelons, pineapples, and a number of other products were declared "commodities" under the Agricultural Organization Act and have since been marketed only through the Tonga Produce Board (Wylie, 1967: 1557-1563).

Bananas became an important export in the first decade of the century. In 1908, over 100,000 cases were shipped to New Zealand at a value of $T28,000. In 1909, however, New Zealand trade restrictions caused a considerable decline in the export of bananas. This decline lasted until 1931 when a satisfactory trade agreement was reached (Naval Intelli-

443 438 [436] market. Exchange is generally on a cash basis.

The market is open every day except Sunday, Saturday having the heaviest trading. On one Saturday, an estimated 350 sellers were present and approximately 2,000 buyers, who 443 purchased about $T3,000 worth of produce. Including non-buyers and socializers, people present may have totalled as many as 5,000 or approximately ten percent of Tongatapu's 443 438 population. A great variety of agricultural products are sold at the market (Table 27). Some items such as rhubarb, [244] okra, parsley, and certain varieties of squash are marketed [241] solely by well-organized truck gardening operations, [795] including the Mormon Church, but most items are grown primarily on bush or town allotments. Most sellers are part-443 time or target marketers, who sell only when they have surplus agricultural products or are in need of cash for a [444] specific purpose. The balance of the sellers, no more than 25 percent, are either representatives of co-operative societies and missionary societies or middlemen who buy products from individual farmers and serve as retailers.

443 438 In short, the market is: 1) a source of cash for rural people; (90 percent of the sellers in the market during a study on January 22, 1972, were from outside Nuku'alofa); 2) an important food source for the increasing urban/non-agrarian population of Nuku'alofa (approximately 85 percent of the food purchased was purchased by consumers in the Nuku'alofa area); 3) an important source of firewood, Tongan medicine,

TEXT CONTINUED ON PAGE 1743

241 Table 31. Frequency and area as dominants of specified staple crops on 101 sampled bush allotments.
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Crop	Frequency Occurrence	Total Acreage as Dominant Crop (Hectares)		% of Total Sample Acreage	% of Subsistence Acreage
Manioc	73	91	(37)	11	37
Yams	53	52	(21)	7	21
American taro	51	59	(24)	7	24
Sweet potato	15	8	(3)	1	3
Swamp taro	14	8	(3)	1	3
Goa yam	8	3	(1)	<1	1
American and swamp taro	7	4	(2)	<1	2
[245] Plantain	7	4	(2)	<1	2
Giant taro	1	1	(<1)	<1	1

In the case of mixed plots of American and swamp taro, it was not possible, in a number of cases, to decide which
241 plant was dominant. In the case of plantains, Goa yams
244 and, to some extent, taro, the frequency of occurrence
245 and total acreage of these crops would be considerably higher, except for the fact that they are usually (especially in the case of plantains and giant taro) intercropped with yams and other crops and are only

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occasionally planted alone as dominants. Nevertheless, Table 31 does give a good indication of the crops most widely cultivated as dominants during 1971.

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None of these staple crops seem to be concentrated in specific areas of Tongatapu.

Supplementary Food Crops

Throughout the matrix of dominant staple crops and bush-fallow vegetation are fcund a variety of supplementary food plants which play an important role in the diet. [125] Because most of these are intercropped with the staple crops or found in bush fallow vegetation, the survey tabulated their frequency and abundance rather than the area occupied. The papaya or lesi (Carica papaya) is the most widespread supplementary food plant, occurring on 88 of the sample bush allotments (Table 32). It is generally found either intercropped with other subsistence crops or as a volunteer in bush fallow. Three allotments had rows of papayas in small plantations, 40 allotments had at least 10 trees, and 45 had 1 to 9 trees.

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In the cases of si (Cordyline terminalis), chili pepper or polo fifisi (Capsicum frutescens), and the cherry tomato or temata vao (Lycopersicon esculentum var. cerasiforme), it may be debated as to whether or not these are indeed "cultivated plants," because they are so commonly found as volunteers. All three species are widespread on

Table 32. Frequency of occurrence specified supplementary food crops found as non-dominants on 101 bush allotments.

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Plant	Number of Allotments
Papaya	88
Cordyline	68
Chile pepper	60
*Bananas	59
*Plantains	48
Edible hibiscus	36
*Pineapple	31
Sugar cane	30
*Fata banana	28
Cherry tomato	19
Pumpkin	17
Kava	14
Garden vegetables	14
Corn	10
Green onions	4
Coffee	3
Lemon grass	2
Amorphophallus	2
Granadilla	1

* Present as isolated or small groups of plants and discussed in detail under commercial crops.

241 borders of cultivated areas or paths.

241 Of the 30 allotments on which sugar cane or to
249 (Saccharum officinarum) was found, 11 had more than 20 plants, 14 had 5 to 20, and 5 had 1 to 5 plants. It is rarely planted in continuous patches and is generally found planted randomly among other subsistence crops or along borders of paths or cropped areas.

241 Pumpkins or hina (Curcurbita pepo) were planted as a
244 continuous crop on only 1 allotment; on 16 others they were either interplanted amongst other crops or found amongst secondary vegetation in recently fallowed areas.

241 Kava (Piper methysticum) roots are used in the pre-
249 paration of the traditional beverage known by the same name. On 5 allotments, it was cultivated in small homogeneous stands of over 15 individual plants; 4 allotments had 5 to 15 plants, and 4 had 1 to 5 plants. One allotment had a large patch about one-half acre (one-fifth hectare) in size. When not cultivated in homogeneous stands it is generally intercropped with other subsistence crops.

241 Garden vegetables were present on 14 allotments, 6 of
244 which had contiguous plots (>1/10 acre), indicating possible commercial cropping (Table 33). Tomatoes or temata (Lycopersicon esculentum), bell peppers or polo (Capsicum annuum) and green beans or piini (Phaseolus vulgaris) were the only ones which seemed to have been grown on a commercial basis. Cabbage or kapisi (Brassica oleracea var.

241 Corn or koane (Zea mays) was planted alone on about
243 one-half acre (one-fifth hectare) of one allotment as a commercial crop. In the remaining 9 cases, it was intercropped with taro or giant taro, planted around the borders of yam patches, or in small mixed vegetable gardens.

241 Green onions or onioni Tonga (Allium ascalonicum) are
244 one of the most important herbs in Tongan cooking. On 3 of
[263] the 4 sample allotments where green onions were present, they were planted in well-ordered rows or homogeneous patches; in only one case were they planted amongst other subsistence crops.

241 Coffee or kofi (Coffea arabica) was found planted in
245 the shade of small groves of trees on 2 allotments and under scattered trees on another.

241 Lemon grass or moengālō (Cymbopogon citratus), the
249 leaves of which are used to brew tea, is generally found on town allotments, but was also cultivated in a small patch near a dwelling on 1 bush allotment and planted along a path through another allotment.

137 Teve (Amorphophallus campanulatus), an aroid, formerly
241 an important subsistence crop in certain areas of the Pacific (Massal and Barrau, 1956: 6), was found on only 2
[26] of the sample allotments. In both cases, it was uncultivated and, according to informants, eaten only in times of famine.

241 Table 35. Frequency of occurrence and acreage of specified crops when present in commercial quantities on 101 sample allotments.
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Crop	Number of Allotments	Total Acreage (Hectares)	% of Sample Acreage	% of Commercial Acreage
Bananas	15	15.2 (6.2)	1.8	42
Watermelons	4	6.1 (2.5)	0.8	17
Plantains	5	4.6 (1.8)	0.6	13
Pineapples	7	3.8 (1.5)	0.5	11
Garden vegetables	6	2.3 (0.9)	0.3	6
Peanuts	4	1.5 (0.6)	0.2	4
Rock melons	2	1.5 (0.6)	0.2	4
Corn	1	0.5 (0.2)	0.1	2
Vanilla	1	0.3 (0.1	<0.1	1

245 orderly rows according to Tonga Produce Board recommenda-
241 tions. In four cases, however, the plantations were poorly maintained and ceased to be productive on a commercial basis. In addition to these plantations in a poor state of maintenance, 67 percent of the sample allotments had
[137] abandoned banana plantations. Most of these plantations were probably abandoned due to black-leaf-streak fungus (Mycosphaerella fijiensis) and bunchy-top virus; the former has been particularly severe since 1968.

241 Plantains or hopa (Musa paradisiaca) like bananas, are
245 susceptible to black-leaf-streak and bunchy top diseases, but there were no abandoned plantain plantations on the sample allotments.

241 Watermelons or meleni (Citrullus vulgaris) are general-
244 ly grown alone on large tracts of plowed land. Occasionally, they are also intercropped with yams, corn, or manioc.

241 The pineapple or faina (Ananas comosus) is generally
245 planted alone, although in one instance it was planted under manioc.

241 Garden vegetables, were present on only 6 allotments
244 where they were planted on contiguous plots (>1/10 acre) indicating possible commercial cropping. Only three crops were obviously grown commercially; these were tomatoes or tomata (Lycopersicon esculentum), bell pepper or polo (Capsicum annuum), and green beans or piini (Phaseolus vulgaris). They were generally found planted alone. There was one mixed planting of bell peppers, green beans, and bananas.

Peanuts or pinati (Arachis hypogaea) accounted for 4 percent of the commercial acreage and were planted alone on plowed plots. On two allotments , peanuts had been recently harvested.

The cantaloupe, rock melon or meleni maka (Cucumis melo var. cantalupensis), which the King of Tonga, Taufa'ahau Tupou IV, has championed as having considerable

241 244 promise as an export crop, was found on 2 percent of the sample allotments, comprising 4 percent of the commercial acreage. In one instance, it was planted alone and, in another, was planted together with manioc.

241 243 [235] Corn or koane (Zea mays) was found in one instance in a large homogeneous stand of approximately 0.5 acres (0.2 hectares). Commercial corn growing on Tongatapu seems to be increasing owing to the establishment of a chicken feed industry, which has offered to buy increasing amounts of dried corn from farmers.

241 245 Vanilla or vanila (Vanilla planifolia) was present on only one of the sample allotments. There were approximately 40 individual plants, each supported by a physic nut tree or fiki (Jatropha curcas). These vanilla plants, like many others that have been recently planted on Tongatapu, were not yet in production.

241 Nature of Intercropping

One of the major foci of the survey of bush allotments was the nature of intercropping practices. The primary focus was on major staple and commercial crops. Supplementary crops are infrequently intercropped with major crops and are more often planted as borders on or around dwellings on bush allotments.

241 244 Yams ('ufi) are generally the first crop planted in a recently cleared area and it is in the yam garden or ma'ala where intercropping is most prevalent. In the 53 instances

241 where yams were present on the 101 sample bush allotments,
244 in only seven cases were they planted alone. Yams were planted with: giant taro (kape) in 41 instances; plantains (hopa) in 15 instances; American taro (talo Futuna or talo tea) in 13 instances; bananas (siaine) in four instances; Goa yam ('ufilei) and Polynesian arrowroot (mahoa'a) in two instances each; and, swamp taro (talo Tonga) and watermelons (meleni) in one instance each. Tongan informants generally said that yams were rarely planted without giant taro and that plantains were often planted in the same plot (in 13 cases both giant taro and plantains were intercropped with yams on the same plot). The general practice is to plant the giant taro and plantains in rows approximately 15 to 30 feet apart, with the yams planted in between. American taro is also frequently planted with yams, giant taro, and plantains. Bananas in some cases take the place of or are planted in addition to the plantains in association with yams. The practice of planting Goa yams or Polynesian arrowroot along the borders of the yam patch was probably more common in the past. In some cases, Goa yams are planted around the bases of giant taro and plantains which serve as trellises.

Of the 53 allotments where American taro was present, it was planted alone in 25 instances; was planted with giant taro in 18 instances; plantains in 18 instances; swamp taro in seven instances; paper mulberry (hiapo) in three

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244 instances; sweet potatoes (kumala) twice; and once with pumpkins (hina). American taro is often planted after yams have been harvested, and the giant taro and plantains, which were originally planted in association with yams, remain among the more recently planted taro. Plantains are also often planted as a follow-on crop to yams. As with any intercropping pattern, there are many variations, and sweet potatoes, paper mulberry or even pumpkins are sometimes planted along with taro after the yam harvest.

Swamp taro, which was present on 21 sample allotments, was planted alone in four instances; with American taro in seven instances; with giant taro in six instances; with plantains in four instances; with paper mulberry in three instances; with kava in one instance; and with both Goa yam and pineapple in one instance. The associations formed with swamp taro seem to be very similar to those formed with American taro. According to Tongan informants, swamp taro intercropped with paper mulberry, kava, Goa yam, or pineapple are common variations.

Manioc (manioke), which was present on 73 sample allotments, was found planted alone in 61 instances; was intercropped with giant taro and bananas in three instances each; with plantains and paper mulberry in two instances each; and with pineapple in one instance. In most of intercropping cases, the manioc seemed to have been planted after the other plants.

241 244 Sweet potatoes (kumala), which were present on 15 allotments, were planted alone in 11 instances and were intercropped once with giant taro, once with bananas, once with manioc and once with a paper mulberry.

The Goa yam ('ufilei), which was present on eight allotments, in two instances was intercropped with giant taro, taro, and bananas; once with giant taro, plantains and bananas; and once with American taro. In the remaining four cases, it was planted alone.

241 [654] [655] The Agricultural Department and Tonga Produce Board generally discourage intercropping of the major commercial crops. However, of the sample bush allotments, 9 had commercial crops intercropped.

241 245 Of the 15 commercial banana plantations on the sample bush allotments, in only six cases was there intercropping. In one instance, the entire banana plantation was underplanted with American taro. In the other instances, manioc, Goa yams, yams, or American taro were planted under portions of the plantation. The actual percentage of the total banana acreage that was intercropped comprised only 4.8 acres (1.9 hectares) or 32.5 percent of the total commercial banana acreage.

241 244 Watermelons, which were present on four sample allotments, were intercropped in only one case; this was with yams.

241 245 Pineapples, which were present in commercial quant-

23| 369 Table 46. Frequency occurrence of specified animals on 192 town allotments (113 Nuku'alofa and 79 in rural villages).

Type	Nuku'alofa Occurrences	Rural Villages Occurrences
Chickens	80	61
Dogs	69	53
Pigs	51	67
Horses	31	47
Cats	33	24
Ducks	18	2
Goats	10	10
Cattle	9	4

[241] to roam free, considerable crop damage is caused by escaped animals. Ducks were more commonly found in the more low-lying and swampy areas of Nuku'alofa.

Staple Crops

241 The same range of staple crops was found on town allotments as on bush allotments (Table 47). However, 241 crops such as manioc (Manihot esculenta), yams (Dioscorea 244 alata), and sweet potatoes (Ipomoea batatas), which were common in large acreages on bush allotment, were present

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244 on 10 percent or less of all the sample town allotments.
On the other hand, staple crops such a swamp taro
241 (Colocasia esculenta), American taro (Xanthosoma spp.),
244 giant taro (Alocasia macrorrhiza), plantains (Musa paradi-
245 siaca), pata bananas (Musa sp.), and bananas (Musa sapientum),
which require more care and are often planted individually,

241 Table 47. Frequency and percent occurrence of specified
244 staple crops on 192 town allotments (113 in Nuku'alofa and
245 79 in the rural villages).
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Crop	Nuku'alofa Number of Occurrences	%	Rural Allotments Number of Occurrences	%	Total Number of Occurrences	%
Swamp taro	62	55%	4	5%	66	34%
Plantains	43	38%	6	8%	49	26%
American taro	44	39%	2	3%	46	24%
Pata bananas	44	39%	2	3%	46	24%
Bananas	43	38%	2	3%	45	23%
Giant taro	35	31%	7	9%	42	22%
Manioc	18	16%	1	1%	19	10%
Yams	16	14%	3	4%	19	10%
Sweet potato	7	6%	0	0%	7	4%
Goa yam	6	5%	0	0%	6	3%

were more common (plantains and bananas are included as staple crops here because they are not cultivated commercially on town allotments). In Nuku'alofa, these crops were grown on more than one-third of all sample allotments. Swamp taro was most common, possibly because of the swampy nature of the low-lying area of Nuku'alofa and the ease with which it can be planted.

The cultivation of all staple crops seems to be much more widespread on Nuku'alofa town allotments than on the rural town allotments. There seem to be three major factors influencing this distribution. First, a higher proportion of people in the Nuku'alofa area have neither tenure or access to bush allotments(Table 48) and consequently depend upon the market and their town allotments as primary sources of agricultural products. Secondly, rural houses are generally closer to their respective bush allotments, which facilitates their use for crops which are especially susceptible to theft. Theft seems to be increasingly bothersome and, consequently, crops which can be grown safely on the nearby bush allotments of rural residents are often grown to a greater extent by Nuku'alofa residents on their town allotments. Finally, probably the major deterrent to more extensive cropping on rural town allotments is the presence of free roaming pigs and other animals. In Nuku'alofa, it is illegal for pigs and other animals to roam free.

241 438 443 Market. Nuku'alofa, which is probably visited by more than 10 percent of the entire population of Tongatapu on an average Saturday. With the exception of garden vegetables grown by large growers on leasehold land and limited produce from other islands, almost all produce and processed goods come either directly or indirectly, as in the case of handicrafts and folk medicines, from the bush and town allotments on Tongatapu.

241 311 Bush Allotments.

Survey results indicated that 34 percent of the area on bush allotments was under cultivation during the 1971 - 72 period. This figure would be somewhat higher if uncultivable rocky and swampy land found on numerous bush allotments is excluded; Hardaker's (1971 : 63) estimate of 36 percent shows close agreement.

241 Of the cultivated land, 87 percent was devoted to subsistence cultivation, 11 percent to commercial cropping, [311] and the balance to a combination of the two. On only one of the 101 sample allotments was there any grazing on natural pasture. 241 Of the subsistence acreage, the most 244 widespread crop was manioc (Manihot esculenta) comprising 37 percent of the total acreage. It was followed by American taro (Xanthosoma spp.), 23 percent; yams (Dioscorea alata), 21 percent; and then by swamp taro (Colocasia esculenta) and sweet potatoes (Ipomoea batatas). Other

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Other important subsistence crops, sometimes planted alone, although generally interplanted with the above crops, were giant taro (Alocasia macrorrhiza), plantains (Musa paradisiaca), bananas (Musa sapientum), and Goa yam (Dioscorea esculenta). Excluding coconut palms, which were considered a tree crop and did not enter into the acreage estimates, bananas (in plantations) comprised 42 percent of the commercial acreage with the balance being made up by other commercial crops such as watermelons, pineapples, peanuts, plantains, corn, and garden vegetables.

[128]

Intercropping is most widely practiced with subsistence crops. Yams are almost always intercropped, mainly with giant taro, American taro, swamp taro, and plantains, and occasionally with bananas or Goa yams. Swamp taro and American taro are often intercropped, and manioc and sweet potatoes are rarely intercropped with other species. Only limited intercropping is practiced with commercial crops, although in a few cases taro was planted under bananas, pineapples under manioc, and watermelons among yams.

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Cropping sequences usually last from two to five years, after which the land is left fallow from two to six years. After clearing the secondary vegetation and associated intercropped species, yams are usually the first crop planted. American taro generally follows yams and in turn is followed by manioc before the land is allowed to

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244 revert to fallow. Sweet potatoes also enter into the sequence, especially in sandy areas. Manioc and taro are commonly replanted on the same plot, in the case of manioc up to four times, before the plot, along with relicts of the
241 taro and/or manioc, reverts to fallow. A great variety of
245 sequences are practiced by farmers, and more recently,
[244] commercial crops such as watermelons and bananas often begin a sequence or are integrated into one. In the case of bananas, the sequence is often broken and with the benefit of fertilization the crop will remain on a given plot for a number of years.

241 In addition to these major staple and commercial crops there is also a great range of other important supplementary food plants, useful non-food plants and trees which are either cultivated or protected in a wild state on bush allotments.

With the exception of Cordyline terminalis, the cherry tomato (Lycopersicon esculentum var. cerasiforme), and the chile pepper (Capsicum frutescens), which are usually protected as volunteers, the most important supplementary food plants are papaya (Carica papaya), edible hibiscus (Hibiscus manihot), sugar cane (Saccharum officinarum), and kava (Piper methysticum), all traditional components of the Tongan agricultural system. Other crops of more recent introduction, include corn (Zea mays), onions (Allium spp.), pumpkins, (Cucurbita pepo), and passion

241 lablab to improve fallow vegetation as well as an increas-
242 ing use of inorganic fertilizers. In most cases, however,
[654] fertilizers were supplied by the Coconut Replanting Scheme or the Agricultural Department for use with coconuts, bananas, watermelons, or export vegetables, rarely for subsistence crops. The practices of mulching or use of animal manure were seldom employed.

241 The use of plows and disc harrows for the clearing
407 and preparation of land was common, and approximately one-half of the allotments have been plowed at one time or another. In most cases, however, plowing was done under
241 [654] the auspices of the Coconut Replanting Scheme. Commercial
[244] crops such as peanuts and watermelons were often grown on plowed land, but plowing for staple root crop production was uncommon.

[244] Most staple crops were well weeded, except for manioc and taro which seemed to compete successfully with weeds.
241 Commercial crops also seemed reasonably well cared for,
245 except in the case of pineapples which were often overrun by secondary growth and some banana plantations where proper desuckering was not practiced and diseased plants were poorly weeded.

241 Tree crops, however, received very little attention,
245 and coconut palms, both mature and replanted, were often
136 found overrun by secondary vegetation, burned around the bases during clearing, or left prey to rat, rhinoceros

241 369 allotments in the urban area of Nuku'alofa but to a lesser extent in the rural villages. The most common staple crops 241 found included swamp taro (Colocasia esculenta), American 244 taro (Xanthosoma spp.), giant taro (Alocasia macrorrhiza), [245] and bananas (Musa sapientum), plantains (Musa paradisiaca), and the pata variety banana (Musa sp.), none of which are usually planted as commercial crops on town allotments. Of lesser importance on town allotments were manioc, yams, and sweet potatoes. Swamp taro, which was not as important on bush allotments, was the most frequently planted crop on town allotments, especially in Nuku'alofa.

241 There was also a great range of supplementary food crops and valuable non-food plants that were cultivated and/or protected. The most common of these were chili pepper (Capsicum frutescens), edible hibiscus (Hibiscus manihot), sugar cane (Saccharum officinarum), si (Cordyline terminalis), kava (Piper methysticum), pineapple (Ananas comosus), passionfruit (Passiflora maliformis and P. edulis), lemon grass (Cymbopogon citratus), and grenadilla (Passiflora quadrangularis), introduced vegetables such as tomatoes (Lycopersicon esculentum), pumpkins (Cucurbita pepo), and eggplant (Solanum melongena). Of the 28 different useful non-food plants found on the town allotments, the most common were species of Pandanus, Gardenia jasminoides, Gossypium brasiliense, and Coix lachryma-jobi. Both [369] supplementary food plants and non-food plants were much

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464 Increase in Wage Labor

Owing to the increasing need for cash, the growing labor pool, and the number of allotment holders who have wage-paying jobs, there seems to be a definite increase in the number of households employing wage-laborers to work on their allotments.

000 Increasing Cultivation on Town Allotments

As the pressure on land becomes more acute, dooryard gardens on town allotments will probably have a greater role in supplying the subsistence needs of the Tongan [illegible]. This trend is already evident in Nuku'alofa, where [241] [369] dooryard gardens trend to be much more highly cultivated than those in the less populous rural villages.

Increase in Permanent Dwellings on Bush Allotments

[423] Owing to the limited number of town and bush allotments, the inability of all eligible land holders in a given family to have legal rights to bush allotments, and the improved transportation system, there will probably be an increase in the number of households living permanently on the bush allotments, and a concomitant intensification of agricultural activities on these allotments.

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178 Increased Cultivation of Non-Traditional Staple Crops

Because of their ease of cultivation and ability to grow on more impoverished soils, there has and will continue to be an increasing dependence on manioc (Manihot esculenta), American taro (Xanthosoma spp.), and sweet

244 178 [438] potato (Ipomoea batatas). These crops, all of which were infrequently cultivated before the turn of the century, now have become the most common items sold at Talamahu Market, and manioc and American taro were the two most widely cultivated crops in terms of acreage.

241 178 Increased Cash Cropping

There will probably be a continued expansion of cash cropping to supply both overseas markets and the expanding [242] [654] urban population on Tongatapu. The major focus of government extension work is the expansion of commercial cultivation of bananas, coconuts, and a variety of other established crops such as watermelon, pineapple, garden vegetables, and root crops; and experimental crops such as [435] macadamia nuts, onions, strawberries, and garlic. The rising prices of products at Talamahu market is also a major incentive for an increase in commercial production of both traditional and recently introduced crops.

434 439 178 000 Increased Cultivation of Crops Used for Handicrafts

With the rapid expansion of tourism throughout the Pacific, there is a great demand for the high quality Tongan handicrafts both in Tonga and overseas. Consequently, there could be a considerable expansion in the cultivation of plants such as paper mulberry (Broussonetia papyrifera), pandanus (Pandanus spp.), Job's tears (Coix lachryma-jobi), and bamboo (Bambusa sp.).

98: Rowlands U-3 (no date) 1961
OU9 Tonga OU9

SATURDAY, November 12, was an important day for the members of the Tongan Women's Association, "KO E LANGA FONUA 'A E FETINE TONGA", for it was the day of their Annual Show. Anxious glances had been cast at the sky, for the Show was to be held in the open air and the weather for some days had been uncertain. However, although the day was overcast, no rain fell and all was well.

Her Majesty Queen Salote Tupou, G.C.V.O., G.B.E., who is President of the Association and who has not missed a Show since the first one was held seven years ago, inspected the exhibits. She congratulated the women on the steady improvement in the quality of the work which had been shown throughout the years.

The Tongan handwork included mats, trays, baskets of various shapes, dress materials printed with island dyes, Tongan curtains and cushions and articles made from shells. A new section this year was that for baby baskets. Other items were soap, starch, buttons and ornaments made from Tongan materials.

The sewing section had men's coats and shirts, children's clothing, embroidered dresses, knitted articles, patchwork quilts and fancy work of various kinds. The cookery section included cakes, scones, bread, jams and jellies, cordials, puddings and various Tongan delicacies.

Evidence of the various interests which had been encouraged among the

[P.34-C]

women was given by the baskets of fruit and vegetables, and the collections of flowers from members' own gardens, as well as by the poultry, eggs, and even little pigs.

Her Majesty presented prizes to the successful competitors in all these sections, and also to the winners of the poetry contest.

Another feature of the Show was the report of the Public Health Officer on the inspection of villages. Shields were presented to representatives of the towns and districts which had been judged the best in sanitation and appearance. These shields for annual competition had been previously donated by Her Majesty Queen Salote, H.R.H. Prince Tu'ipelehake and a former British Consul in Tonga, Mr. A. C. Reid, and his wife.

The schedule has already been drawn up for the next Show, at which it is proposed to have special sections for those who have not previously won prizes.

[P.34-D]

/154 cont./

241 433 184 The following examples from a remote village and from a settlement near a seaport may show the proportion of the various products grown (survey taken April/May 1952):

	Of 97 households engaged in agriculture in 'Uiha/ 'Uiha (Ha'apai) the following number plant:	Of 42 households engaged in agriculture in Fungamisi/Vava'u the following number plant:
Yams	92	42
kape	83	42
Sweet potatoes	93	13
Manioc	96	34
Taro	93	41
Bananas	89	42
Sugarcane	46	24
Maize	67	14
Watermelons	58	6
Pumpkins	24	13
Pineapples	--	29
Onions	--	3
Cabbage	3	1
Tomatoes	1	1
Peanuts	4	1

241 262 137 /155/ Among the chief crops (yams, kape, sweet potatoes, manioc, taro and bananas) which, together with the coconut palm and the breadfruit tree, constitute the staple food of the Tongans, only manioc is a plant imported during the European period, while all the rest (including sweet potatoes) were favorite food plants even in ancient Tonga. (409)

409. See J. Cook, Beschreibung...loc. cit. VI. pp. 163, 236/237, 283/284; W. Ellis, An authentic narrative.../cited in English/ I. p. 89.

137 244 Manioc is mentioned for the first time in Tonga in 1865 by West (410)

244 [137] /155 cont./

410. Th. West, Ten Years..../cited in English/ p. 139.

as a newly introduced plant, and at that time it was obviously of little importance. The conditions for growing of manioc, however, seem to be quite favorable in the Archipelago with respect to climate and soil, so that the plant, the cultivation of which is, moreover, very simple, has since then become widespread. Particularly in the [134] Ha'apai group where, as a result of over-population, the soil has been [262] used to excess and is in part exhausted, it has taken on greater importance in the diet of the natives, although they still give preference if possible to their old crops--for reasons of taste and 241 tradition. For the rest, the gifts of seeds left on the islands over centuries by sailors, researchers and missionaries have had relatively little success. Maize which grows well in Tonga is planted in small amounts, and watermelons and pumpkins have not taken on great importance; pineapple is little planted and then mostly to be sold, and there is still very slight interest in onions, cabbbage, tomatoes and peanuts.

242 In the entire Archipelago--even in the Ha'apai group with its over-population--the Tongans have retained their old system of crop rotation with its accompanying "fallow season": after clearing the bush land they plant yams; the second year kape and/or taro (or sweet potatos or manioc) are planted; beginning with the third year they let the land in question rest (for about three years). (411)

411. Sometimes they also plant manioc the third year and only then let the land lie fallow for several years.

A period of fallow is, however, observed only if yams are part of the crop rotations. For example, they plant taro, manioc or bananas continuously or alternate them, so that some land has not had a rest period 241 for several decades. They are not familiar with fertilization, except

/158 cont./

000 kape (less often taro or yams). With these tools they usually work
241 standing. The former, apparently customary, squatting method of work
412 (418)
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418. See, for example, J. Wilson, A missionary voyage.../cited in English/ p. 245.

407 is used only by a few very old men. Plows as well as other agri-
177 cultural machines and tractors are used by Tongans under the guidance
242 of whites only on the state experimental farms on Tongatapu and on the property of Crown Prince Tungi on this island.

121 The following survey may give an insight into present-day agri-
241 culture and show the changes that have taken place.

244 'ufi - Yams (Dioscorea alata L.)
262 Even in ancient Tonga yams were one of the most important food
198 plants (if not the most important crop). (419)

419. See J. Cook, Beschreibung...loc. cit. VI. pp. 163, 237, 283/284; W. Ellis, An authentic narrative...I. p. 89.

[563] White employees in the Tongan government have so far discovered 80
[137] varieties of yams in the Archipelago; more than 20 different names are familiar to the average Tongan. Yams are still the favorite tubers on all the islands, though their total cultivation has decreased in Tonga in comparison with the past (see above); in the Ha'apai group yams are today planted to a lesser extent, whereas their cultivation on the larger islands of the Archipelago (for example, Tongatapu) is still quite extensive and in some places probably corresponds to that of the past.

244 Planting time--with certain shifts as a result of the long north-
221 south extension of the Archipelago--extends from June to the first days of August and from the third week of August up to October-November. As
244 a rule, a yam crop is planted only on land that has rested; suitable
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/158 cont./

244 [242] [412] ground is recognized by the type and size of the wild plants growing there. The weeds are cut down with the thrusting iron (huo lafa-lafa) (see above) and the machete (hele pelu) (see above). After a week or so the dried weeds are burned and the land is cleared--for example, [462] swept. Women also take part in this work, whereas all the rest of the cultivation activity is the business of the men. The holes for plant- [412] ing are dug with the Tongan "digging-stick spade" (huo spade) (see [804] above) to a depth of 0.5 of a meter to one meter and approximately one-fourth of a meter in diameter; the distance from one plant hole to the next (approximately 1.80 to 2 meters) is measured by the eye or with a measuring tape (European tape or coconut cord [kafe]) and a stick or stalk, so that rows are formed and the entire layout of the "yam garden" looks like a chess board. The /159/ plant holes are filled loosely with earth so that the tubers can grow deep into the ground. On the soft earth one piece of yam root is lain four to six weeks in an earth-covered pit approximately one-half meter deep, for sprouting.) Over the plant pieces the natives heap the earth with their hands to form small hills. After a week or two the young plant grows out of the hill. They cut twigs and lay them under (between) the plants, so that the latter can "climb"; (420)

> 420. A special type of yam ('ufi lei) is also allowed to climb up dead tree trunks, posts, cords and wires.

today this saves the natives the work of having to turn over the ground in the field every day to protect the plants from scorching in the hot earth. The weeds which soon appear are removed--generally [412] every week or two--with the huo lafa-lafa. The harvest takes place after eight to twelve months (depending on the variety). After the yams have shown that they are ripe by the leaves turning brown and drying up, the tubers are taken out of the ground. First the natives

/159 cont./

244 dig with their hands until they feel the beginning of the tuber, then they continue digging with the huo spade and scoop the earth out with their hands. After they have felt the end of the yam root they fix it with the huo spade held against the opposite side of the dug hole and pull it out with their hands. They remove the earth from the tubers, fill up the holes and take the harvest home to their village.

[251] There they store the yams, which can weigh up to 50 pounds, but average from three to ten pounds, in the cook hut, under raised dwellings or in special storage huts. Yams can be stored for a long time, but usually the harvest is consumed in two to three months.

Kape = a plant related to taro (Alocasia macrorhiza Schott)
Kape was planted even in ancient Tonga. (421)

421. See J. Cook, Beschreibung...loc. cit. VI. p. 237.

[262] Its importance for the native has probably remained the same, if it has not increased (especially among the Ha'apai group); on the island of Nomuka, for example, it, together with manioc, is the chief food. The thick, rhizome-like lower stalk is eaten, not the tubers. The Tongans distinguish four main varieties of kape. The plant, which grows considerably larger than taro, is planted in special "kape gardens" or (more often) individually (for example, in yam or sweet-potato fields).

[221] Planting time is from March to September, but especially during the last three months of this period. The natives plant kape on land cleared of weeds (in mixed planting together with yams or sweet potatos). With a huo spade they dig holes approximately 15 centimeters deep and in these they plant seedlings which they fetch from a harvested kape field (where the tubers are left lying in the ground), or they place a tuber in the hole. They also plant the seedlings in earth broken up by a simple digging stick (huo langa) (see above). In a yam-

244 412

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244 kape "garden" they plant the yams some 3.50 meters apart and set the kape between each of these. Weeding is done every week or two, especially during the first period of growth. The plant, which grows [412] from one year to the next, the natives harvest after one and a half to three years by cutting off the leaves with the machete (or the huo spade), removing the earth around the rhizome-like stalk with the huo spade and then lifting the stalk /160/ out of the ground with their hands. The roots and tubers are left in the ground. The stalks reach [251] an average length of approximately one and one-fourth meters and can be kept for two or three months.

kumala = Sweet Potato (Ipomoea batatas Poit.)

The sweet potato (with its yellowish tubers) has been cultivated for a very long time in Tonga. (422)

422. W. Ellis, for example, as early as 1777, regarded them as one of the Tongan crops (W. Ellis, An authentic narrative...I. p. 89.)

[139] It is not clear, however, when and how the sweet potato, which was very probably indigenous to South America, came to Tonga, or to the South Seas in the first place. This cultivated plant still enjoys great popularity, but it is not planted to the same extent on all the islands (allegedly on account of different soil conditions) The Tongans distinguish between some ten varieties (on the basis of color and degree of firmness of the tubers).

[221] Planting time is from March to September, but particularly in May and June. The natives plant the sweet potato by digging up small hills with the huo spade or the huo lafa-lafa on the land that has been cleared for planting. Into the hillocks they dig a hole with their hands and set in four or five stalk cuttings (tendrils with leaves). The sweet potato is usually planted in an open field, but sometimes, for lack of space, it is planted between coconut palms

/160 cont./

244 (as are yams and manioc at times). The distance from one plant to
[804] another is about one and one-half meters (by eye measurement; arrangement in rows). During the first period of growth weeds are combated. After three or four weeks the hill around the plant is heaped up more. Finally the leaves have grown to such an extent that the sweet potatoes take over the land and maintenance is no longer necessary. The harvest takes place in six or seven months. The natives either simply pull the plants out of the ground with their hands, dig out the sweet potatoes with their hands and continue digging (with a pointed stick, the huo spade or the huo lafa-lafa) until all the tubers have been found, or else they first cut off the stalk (for example, with a huo lafa-lafa), dig out the sweet potatoes with the same tool or with their hands. The hole is refilled with earth. In Tonga, the sweet potatoes weigh an average of about three pounds
[251] (the largest, about eight pounds). They may be stored up to four months.

manioke = Manioc (Manihot dulcis Baillon [?])

244 Manioc is scarcely more than 100 years old in Tonga, and un-
137 doubtedly owes its introduction in the Archipelago to Europeans; its importance for the food of the natives is today considerable and exceeds that of other cultivated plants. The natives distinguish some eight varieties in the Archipelago, chiefly by the color of the
244 leaves and tubers. Manioc produces a relatively high yield even on soil that is less good.

[221] Planting occurs during all months of the year, nor is the harvest restricted to a specific time of the year. The natives plant manioc on a cleared plot of land by digging up small hills with the huo spade (or the huo lafa-lafa), or often with a European fork, and setting two or three stalk-seedlings (cut off from old manioc stalks with the

/160 cont./

244 machete (also with the huo spade or the huo lafa-lafa) about a foot above the ground and with this stub they pull the tubers (which are barely 50 centimeters long) out of the ground and dig farther for those they have not pulled out. The tubers must be used up soon, since [251] they keep for only two or three days.

The manioc planted in Tonga for food is not noticeably poisonous. The natives take no precautions. Only the manioc often used nowadays to [824] [287] glue bark cloth is poisonous and is carefully stored away from domestic animals.

talo = Taro (Colocasia esculenta Schott)

[262] Taro is one of the ancient cultivated plants of the Tongans (423).

423. See J. Cook, Beschreibung...loc. cit. VI. p. 237; W. Ellis, An authentic narrative... I. p. 89.

but in the past, as today, it has never had great importance in the diet of the natives; the Tonga Islands are too arid for a extensive taro cultivation. Nevertheless, the natives take the trouble to plant a certain amount of taro. They distinguish between three main varieties.

[221] Planting time is from June to September (seldom to December), but particularly during the months of August and September. The native cut down and burn the weeds on the land where they propose to grow taro.

[462] Here too the subsequent "sweeping" of the residue is often done by the women, whereas all the rest of the work is the business of men. Sometimes they also plant taro after the yam harvest in the holes of the harvested tubers or together with the yams. They dig the planting holes for taro approximately 30 centimeters deep with the huo spade and place in them pieces approximately 12, 15 centimeters long) of the rhizome-like taro stalk. The planting holes are then covered with earth in such a way that a depression of some ten centimeters remains, so that in case of rainfall the water can gather in it. A simpler, more

/160 cont./

244 convenient method is to loosen the soil with the huo lafa-lafa (or a European pitchfork), break it up and shove the plant section into it. The distance between plants is about one meter. Every two weeks or so the taro plant is weeded with the huo lafa-lafa. After about a year, often two years or even three to six years, the harvest takes place, at no particular time of year. They cut the stalk with the huo spade close to the ground, then dig out the tuber--around the stub from the outside inward--and carefully feel with their hands to salvage all the tubers. The following are other harvest methods: After cutting the stalk they split the exposed parent tuber with the huo spade by a perpendicular thrust, hoist up the two halves and then dig further with their hands to free the tubers. They also simply tear the plant with the parent [262] tuber out of the ground. During periods of food scarcity the stalk of the plant is sometimes also eaten.

245 hopa, pata, siaine = Bananas (Musa species)

[262] Bananas have been planted in Tonga since ancient times. Cook refers to them as the most important food plant, along with yams. (424)

424. See, for example, J. Cook, Beschreibung... loc. cit. VI. pp. 163, 236, 283.

Today too /162/ bananas belong to the major crop on all the islands of the Archipelago in terms of providing food for the inhabitants. Several varieties of bananas have long been planted on the Archipelago. (425)

425. Cook mentions, for Tongatapu, "fifteen varieties" of the "pisangs" (J. Cook, Beschreibung...loc. cit. VI. p. 236).

[137] It is not clear whether the siaine, which the natives throughout the Archipelago are not fond of eating, is a strain introduced under European influence.

[221] Bananas can be planted all year long. The natives like to plant them individually in yam, kape, taro or manioc "gardens"; but they also lay out special banana plantations, as in the days of Cook. With the

/163 cont./

245 a long time. It grows wild in the bush (plantations) and, like the [221] breadfruit tree, is also planted. Principal harvest time is November- [262] December. The fruits are much liked by the Tongans.

koane = Maize (Zea mays L.)

[137] This plant, introduced in Tonga by Europeans, seems the most suitable species of grain for this climate, but has attained little importance on the islands.

249 to = Sugarcane (Saccharum officinarum L.)

is an ancient Tongan cultivated plant (433)

433. See J. Cook, Beschreibung...loc. cit. VI. p. 284; W. Ellis, An authentic narrative... I. p. 89.

and thrives on the islands. Since the Tongans, however, do not engage in sugar production and no industry of this type was established in the Archipelago by Europeans, the planting of sugarcane has remained very limited.

244 hina = Pumpkin (Cucurbita pepo L.)

[137] was introduced by Europeans in Tonga. It is planted and also occurs [262] in the wild state, but is not much liked by the natives.

meleni = Watermelon (Citrullus vulgaris)

[137] likewise came to the Archipelago through European influence. It is usually planted, but is also sometimes found growing wild. The Tongans [262] like to eat watermelon, but they have not yet cultivated this plant extensively. /165/ On many islands the melons are also destroyed by harmful insects.

faina = Pineapple (Ananas comosus)

[137] This cultivated plant, also introduced by Europeans, has become [432] quite popular, yet it is by no means commonly planted. On the main islands the natives like to plant pineapple to sell. As a result of the negligence of the natives and the unfavorable location of the plantings (in part far from the villages), the pineapple is often

/165 cont./

244 hindered in its growth by weeds or is eaten by horses and rats.

pinati = Peanut (Arachis hypogaea L.)

[137] This was also brought to Tonga by whites. The natives are fond of
[262] peanuts, but have so far paid little attention to its cultivation

245 moli = Orange, Lemon, Grapefruit, Tangerine (Citrus species)

[137] Some of these grew in the Archipelago even in olden times (grapefruit!) (434)

434. See G. Forster, loc. cit. V. p. 150; J. Cook, Beschreibung...loc. cit. p. 236.

and were in part introduced by Europeans. These fruits, with the exception of lemons, are very popular among the Tongans. The moli are planted in the villages as well as on plantation lands, but there they mostly

[136] grow wild. On many islands a fruit fly has caused considerable damage to oranges.

[137] lesi = Papaya (Carica papaya L.)

was apparently introduced by Europeans, but a long time ago. Today it is widespread in the Archipelago, grows wild, but is also planted in

[262] bush land and sometimes in the villages. The natives are fond of the
[252] fruit (raw, cooked or steamed in the earth oven).

fekika = Malayan Apple (Eugenia malaccensis L.)

has probably been indigenous since ancient Tongan times. (435)

435. Perhaps Ellis means the Malayan apple when he says: "a fruit resembling an apple, which we never saw ripe" /quoted in English/ (W. Ellis, An authentic narrative...I. p. 89).

Some of the trees grow wild in the api 'uta, some are planted there.

[262] The Tongans love the fruit, but today, as in the past, it is not very important in their diet as a whole.

241 vi = (Spondias dulcis Forst.)

seems to be indigenous in Tonga and largely grows wild on plantation

[262] lands. The natives like the sweet fruits.

/165 cont./

245 [137] tava = (Pometia pinnata Forst.) is said to have been brought to Tonga from the Fiji Islands. (436)

436. See Th. West, Ten Years.../cited in English/ p. 133.

The tree occurs in the wild state and is also specially planted. The [262] fruits are popular among the natives.

/166/ ifi = (Inocarpus fagiferus [Park.] Fosb.) occurred already in ancient Tonga. (437)

437. See J. Cook, Beschreibung...loc. cit. VI. p. 284.

[262] The tree is planted, but also grows wild. The natives cook the fruit [252] and also steam it in the earth-oven, in the traditional way.

241 [137] vaine = (Passiflora speices) was brought to the Archipelago by Europeans. The fruits of the vaine [262] are generally planted, but also grow wild, and are eaten raw.

apele Tonga = (Annona reticulata L.) [137] probably also came to Tonga through European influence. The apele [262] Tonga is sometimes planted, mostly grows wild. The fruit is eaten raw.

'avoka = (?) was apparently likewise introduced in Tonga only a few decades ago. On some of the islands the natives like to plant 'avoka, but it also [262] grows wild. The fruit is eaten raw.

244 si = "Sugar Tree" (Cordyline terminalis) is a plant that was already indigenous in ancient Tonga. (438)

438. See J. Cook, Beschreibung...loc. cit. VI. p. 284.

The si are often planted on the api 'uta, but also in the villages; [252] moreover, they grow wild. The root is used: it is steamed in the earth-oven to obtain the sweet juice (by chewing or pressing). The importance of this plant has probably decreased, since today the natives on all the islands can buy cane sugar cheaply from Fiji.

244 137 Cabbage, Onions and Tomatoes,

/166 cont./

244 [137] which were often brought to the Archipelago by Europeans, are planted in very small quantities on the Archipelago. The Tongans have scarcely been able to develop a liking for these useful plants, especially since they do not thrive as a result of the careless and neglectful way they are tended.

489 [361] Since the plantations are sometimes a considerable distance from the dwellings--in contrast to ancient Tongan times--the question of how to transport the harvest (which sometimes consists of many heavy 482 tubers) must be solved. The Tonga often still use old ways of carrying. 198 To transport coconuts, for example, they split the outer skin of the husk like splints, then tie into a bundle four or five splints and carry home on their shoulders two of these bundles by means of a coconut leaf stem (to which the bundles are attached, front and back). Harvested tubers, bananas, etc., are most often carried in the traditional coconut-leaf baskets (kato lou niu) hastily plaited on the plantations, which the natives /167/ likewise carry by means of a coconut leaf stalk (resting on their shoulders and notched so that they can hook the basket on). The coconut leaf stalk is stuck through the basket itself. Often, the handles of the farming tools (for example, huo spade, huo lafa-lafa) are used as carrying sticks. The horse, which was brought 492 [136] to Tonga by Europeans, renders many natives important service as a [493] riding and pack animal, and some natives own two-wheel European carts [199] drawn by horses, which very much facilitate the transportation of even abundant harvests to the villages.

241 Seen as a whole, Tongan agriculture seems to us little changed. 198 The traditional crops (supplemented by manioc) still form the basis 199 of the food of the inhabitants. The significance of cultivated plants introduced by Europeans is no more than "supplementary." The tools and methods of cultivation are also basically the same, though improvement and additions to the tools, as well as a certain lapse in

/189 cont./

262 184 This list shows that 228 out of 353 'Uiha meals consisted exclusively of products that were available even in ancient Tonga, while 69 of the 173 Fungamisi meals were prepared on a purely "ancient Tongan basis." The influence of the seaport of Neiafu on the village of Fungamisi is recognizable; the example of the European and half-caste households there, as well as abundant supplies in the shops of that town clearly influence the standard of living of the neighboring settlement. The proportion of salted meat, corned beef, white bread, butter, tea, etc., is noticeable. The "European ingredients" (483)

262 184 177

483. "European ingredients" include all foods that were not available in ancient Tonga, but reached the Archipelago only as a result of European influences and are procured today by planting (for example, manioc, see pp. 231-232, 240-241) or by purchase from shopkeepers (for example, corned beef, roast beef, salted meat, sugar, flour, white bread, zwieback, tea, cocoa, coffee).

(244) (432)

of 'Uiha and Fungamisi meals are usually no more than "supplementary." /190/ Manioc, however, appears as a basic food, and in Fungamisi there are a few families who have already gone over to regular bread meals. The very large proportion of breadfruit is due to the fact that the months of April/May are the main harvest time for it.

262 (221)

262 264 Basically, the meals for Sundays, holidays and feasts are the same as everyday meals; they differ only in quantity and in richer ingredients (and sometimes more complicated preparation). As examples we list 12 Sunday meals in the village of 'Uiha (April 1952) and four gala meals (faka afe) (484)

(527) (574)

484. See p. 142-143.

on Nomuka (December 1951):

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226
291

13. Spearing fish

244
412
291

14. Harvesting yams

[End Plate 7]

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241 Yams are the first crop produced during the cultivation
244 cycle, given sufficiently fertile soil. Most farmers interviewed stated that they grew two crops of yams on a given planting site, before proceeding to the next cultivation stage. Interplanted with the yams are a variety of other miscellaneous vegetables, bananas, kape (i.e., giant taro), or plantains. In densely populated areas, such as western Tongatapu, taro is occasionally interplanted also. In regions in which sandy soils prevail, sweet potato instead of yam often starts the planting cycle. This is usually followed by bananas, plantains or cassava.

Following the yam harvest, taro, cassava or sweet potato is planted. While surveys indicate that there is no established pattern or sequence of cropping following the yams, taro was found to be the usual second crop. Most farmers produce two plantings of the second crop prior to the third cultivation stage, which most often involves the production of cassava. Up to six croppings of cassava are produced, although this figure is not the norm. Cassava is occasionally found sparsely planted on fallow land, or growing wild, especially in the densely settled areas of Ha'apai, where the
241 fallow period is much shorter, owing to less available land. An
[244] almost endless number of variations of planting and intercropping was reported by individual farmers. However, as the first planting was usually yams, the last planting was usually cassava, for reasons of soil depletion and the ease of cassava production (i.e., the lack
[245] of tilling, weeding, and grass control). Only occasionally did the sequence end with bananas, rather than a tuber.

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241 Two features of the bush fallow system of particular interest are crop interplanting and crop succession. Interplanting was found to be practiced by over 90 percent of all landowning farmers engaged in cultivation. When questioned as to the reasons for this practice, the most frequent response concerned a desire for increased production on limited land. However, several additional advantages were observed. Interplanting reduces farm labor requirements, in terms of weeding, to only minor maintenance activities. Interplanting also retards soil erosion, such as on the steep slopes of Vava'u and the more sandy soils of Ha'apai. In addition, it is believed that the soil nutrient requirements of interplanted crops are frequently complimentary, although this was not tested.

242 241

The cycle of crop succession in Tonga is primarily based upon a farmer's knowledge of his land's condition and fertility, plus the fertility requirements of individual crops. Yams are planted first because they require a loose soil, such as is found following the clearing process, and a higher soil fertility.

241 242 244

Taro and cassava, the most frequently planted second and third crops, are less demanding on soil fertility. Cassava is particularly notable in this respect. Thus, in the more densely settled portions of Tongatapu and Ha'apai, where the fallowing periods are much shorter and, consequently, soil fertility is lower, cassava is more frequently cultivated.

241 [244] [245]

Tuber cultivation, such as for yam, taro and cassava, represents the principal farming activity in the Kingdom's food production. However, several supplementary crops are noteworthy, the

241 Cash cropping (to be discussed in greater depth later in this chapter) in the bush fallow system can be divided into long- and 241 short-term crops. The principal short-term crops include bananas and 245 a variety of melons, plus miscellaneous plants. Bananas, as [244] described above, may be interplanted in the normal planting cycle. Usually, banana cropping is continued for several years before a 245 plot is returned to fallow. Production from this crop is allocated [262] to household consumption, or sold in local markets. Surveys encoun- [438] tered only an occasional farmer producing bananas for the international [439] export market. Subsequent interviews indicated several limitations on this type of production, such as plant disease and inadequate shipping facilities.

The most severe diseases affecting banana production are black leaf streak, bunchy top, and banana scab moth, the most serious being black leaf streak. Decreases in the production of exportable bananas since 1967, equaling 83 percent of the 1967 crop, have been attributed largely to this particular disease. Leaf streak is a fungal disease, characterized by a dark streaked appearance on the plant leaf (Plate 2).[A] The disease, by decreasing the total leaf area of the plant, thereby reduces the plant's photosynthetic capacity. The results are smaller fruit, smaller numbers of fruit per bunch, or frequently the complete absence of fruit.

Banana bunchy top is a viral disease, also reducing the photosynthetic area of the plant. It is characterized in the field by the insequential order in which the plant leaves die and the bunched appearance of remaining leaves (Plate 3, p. 74).[B] Bunchy top

A, B [Because of poor quality of reproductions in the original, plates have not been marked for a Category--Analyst.]

[TEXT CONTINUED ON PAGE 75]

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245 retards the growth and development of the plant, and terminates fruit production.

[36] Banana scab moth, most destructive during its larval stage, may cause damage ranging from simple fruit discoloration to total [242] destruction (Plate 4, p. 74). DDT, which is frequently used to combat scab moth, has been ineffective in annihilating the pest.

241 The combined effect of these three diseases have reduced 245 internationally marketable banana production by nearly 1.5 million [433] dollars, representing approximately 30 percent of total agricultural [439] export production since 1967. Farmers are increasingly hesitant to initiate large scale banana production, unless guaranteed assistance in combating disease and plant destruction.

245 Survey interviews also attributed decreasing banana produc- 505 tion to inadequate shipping facilities. Frequently, harvested bananas are placed on a dock to await the arrival of transport 245 vessels destined for overseas markets. During this time, the fruit 439 becomes over-ripe, falling below export quality. As a consequence, [435] fruit originally priced up to $1.90 per case may be sold for as little as 40 cents. Because of this potential low cash return, 245 many interviewed farmers stated that large scale banana production was an unwise economic risk.

244 Commercial production of melons, especially watermelons, is also hindered by the inadequate scheduling of transport facilities to [505] overseas markets. Melons are also produced for Tongan markets, but [438] frequently earn only low prices, even when out of season.
[435] A [Because of poor quality of original reproductions, plates have not been marked for a Category--Analyst.]

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249 [241] Of the miscellaneous crops produced, two are particularly noteworthy--sugar cane and peanuts. Sugar cane is frequently produced on the farms of Vava'u, although limited cultivation may be found [257] throughout the nation. Sugar for domestic consumption is not produced in the Kingdom, and mature cane is sold in small unprocessed sticks, much like candy.

244 Peanuts have a great potential for expanded production in Tonga. The presence of a domestic market for peanuts is apparent throughout the Kingdom, and the potential dietary value of this product should be recognized. Employees within the Tongan Ministry of Agriculture blame the lack of extensive peanut production on the laziness of individual farmers. On the other hand, farmers refuse to plant peanuts without guaranteed aid for the necessary machinery and fertilizers.

245 [439] [241] Coconut is the best example of long-term cash cropping. Products of the palm, principally copra, equal approximately 85 percent of Tonga's total international export. Cultivation of palms is conducted independently of the food crop planting cycle. If well cared for, young palms will reach initial production four to six years after planting, although seven to nine years was frequently reported in interviews as being the time required prior to production. The coconut palm will produce for up to 70 years, with 50 to 60 years [136] being the norm. However, rats and beetle damage claim up to 25 percent of all potential produce.

241 245 Palms are often not planted in an orderly fashion on a typical 'api, being planted in a seemingly random distribution. An

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241 diminishing return, during which nutrient demands upon the soil by
134 weeds and grasses are equal to or greater than that being restored.

As stated previously, a further complication to soil fertility results from the traditional practice of burning-over the land, prior to initiating the planting cycle. The burned vegetable residue represents a return of a thin layer of mineral ash to the soil, consisting primarily of calcium, magnesium, phosphorus, and potassium. With the addition of rain and new plant growth, these mineral components become mobile within the soil. However, the nitrogen contained in the fallow vegetation is lost in the burning process, and therefore not returned to the soil. Thus, available nitrogen for crop production may actually be reduced.

241 The fallowing period may last from one year to as long as ten years. Examples of these longer fallowing periods were encountered in interviews, as well as occasional plots which had never been fallowed. The average time schedule consists of three to six years in fallowing and two to four years in cropping. However, no farmer reported following a predetermined schedule, basing decisions upon crop yields.

241 Variations in the length of time allotted to cropping and
182 fallowing were noted in relation to population density. In Ha'apai and western Tongatapu, where land shortage is related to population density, relatively short periods of fallowing are followed by
[244] longer periods of cropping. In addition, the practice of retaining cassava growth, and occasionally taro, on fallow acreage was noted in these regions. Explanations for this, presented during interviews,

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241 density in excess of 600 persons per square mile, in some regions.
178 Surveys determining fallow periods evidenced a marked decrease in
161 fallow time in Ha'apai and densely settled portions of Tongatapu,
241 and a subsequent lengthening of the cropping cycle. In many cases, cropping is continuous, considering the frequent practice of sparsely planting fallow acreage with tubers.

241 The use of fertilizers necessary in offsetting the nutrient
242 depleting effect of intensive cropping is not financially feasible nor understood by the typical Tongan farmer. The issue of maintaining soil fertility is of critical concern to the few agricultural and soil technicians in Tonga. However, owing to prohibitive cost, scarcity, and lack of knowledge, it is expected that most Tongan farmers will continue to rely upon the fallow system for replenishing soil nutrients.

241 The problems of soil fertility and land availability in
244 Tonga have resulted in the increased cultivation and household
178 reliance upon taro and cassava as major food staples.[1] Cassava
[262] represents the best example of the variation in food cropping
241 brought about by increasing pressure upon the land. In a status
244 ranking of tubers grown in Tonga, cassava is found at or near the bottom. However, even though the least desirable, cassava is the

[1] Both tubers were introduced into Tonga in the nineteenth century, although a variety of taro was cultivated in Tonga prior to that period. The introduced taro varieties are more tolerant of dry, upland conditions, as opposed to the marsh requirements of the earlier species. Today most taro is cultivated without a marsh environment. Cassava is an introduced food crop. Of the cultivated tubers, cassava is lowest in status and its increasing cultivation is due to necessity, rather than any growth in popularity.

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241 easiest to cultivate, plant or harvest, requiring very little care
244 for a high yield. In addition, of the tubers grown in Tonga, cassava is the least demanding upon soil fertility and is the most tolerant of drought. Survey data indicated that cassava is cultivated the most in the densely populated portions of the islands or in those areas where land availability is limited.

262 The increasing reliance upon cassava presents a potential
146 nutritionally detrimental situation. Cassava as food is nutritionally unbalanced in several ways, particularly in protein content. Protein derived from cassava is deficient in the sulfur essential amino acids. Therefore, most cassava protein, low in total value to begin with, is unavailable for use by the human body. The consumption of cassava, in lieu of more nutritionally balanced foods, could result in protein deficiency in several segments of Tongan population, including pregnant women and preschool children.

241 The increase in cassava cultivation has seemingly brought
244 about a corresponding decrease in the cultivation of yams. Though
[178] the yam is the most prestigious of the major tubers, yams are a much more labor intensive crop than cassava, requiring intensive soil preparation, careful planting, weeding and harvesting. In addition, yams are more demanding on soil fertility, and with increasing cash cropping and decreasing land availability, less land is suitable for yam cultivation. The trend toward decreasing fallow periods does not permit sufficient soil nutrient accumulation for favorable yam growing conditions.